

Unit 3.2: Impacts, Vulnerability, Adaptation, Policy and Discourse

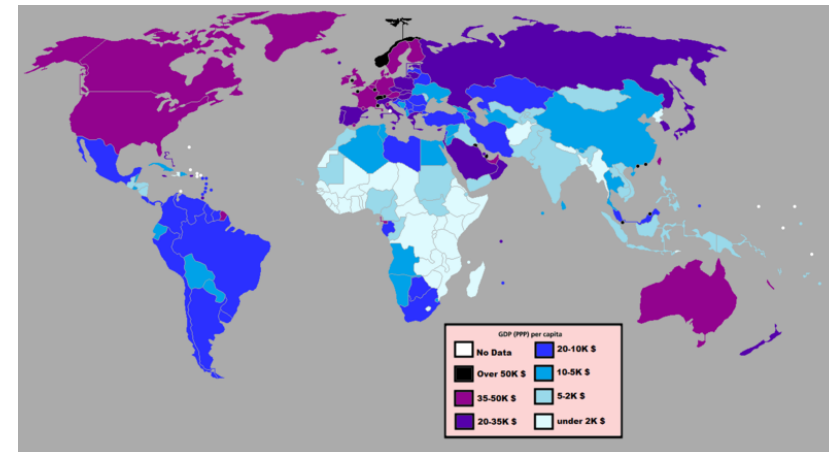
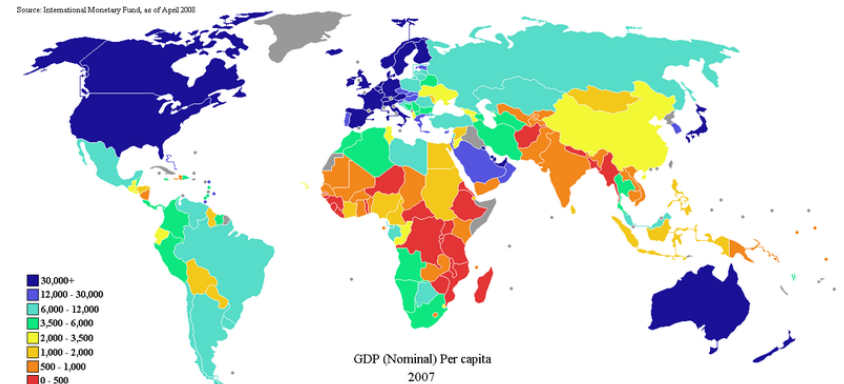


Adaptation and Risk

- The adaptive capacity of a region or a community is often largely dependent on what scale of risk it faces
- The “risk equation”: $\text{Risk} = \text{hazard} * \text{population exposed} * \text{vulnerability}$
- Hazard is the natural incidence of a damaging environmental event – largely geophysical
- The population exposed and its vulnerability are a function of socioeconomic, political and cultural factors
- Resilience: the ability of a community to manage damages associated with climate/environmental damage
- Much of the reason for the differentiated impact outcomes is due to differences in population exposure and vulnerability
- To understand the need for global adaptation and the scale and distribution of global vulnerability, one must understand global socioeconomic inequity
- Much of socioeconomic inequity in the 21st and late 20th centuries has a colonialist/post-colonialist legacy

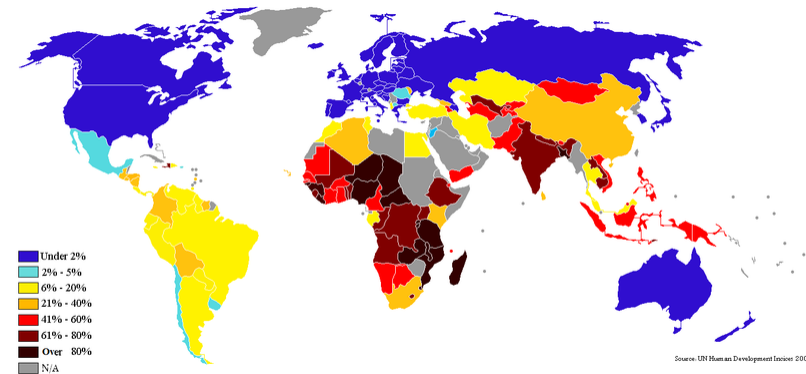
Socioeconomic inequality between nations

- GDP varies widely: (consumption + investment + government spending + net export) / population
- GNP also includes exchange of foreign assets
- Purchasing Power Parity adjusts for cost of living and also varies widely (but not quite as widely)
- Most countries in the tropics are poor
- Most of the wealthy countries are in the middle to high latitudes



Socioeconomic inequality within nations

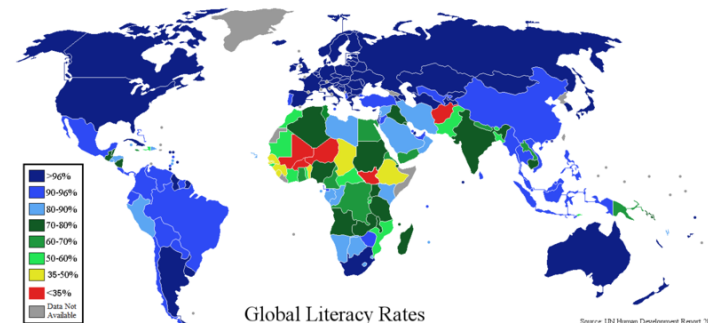
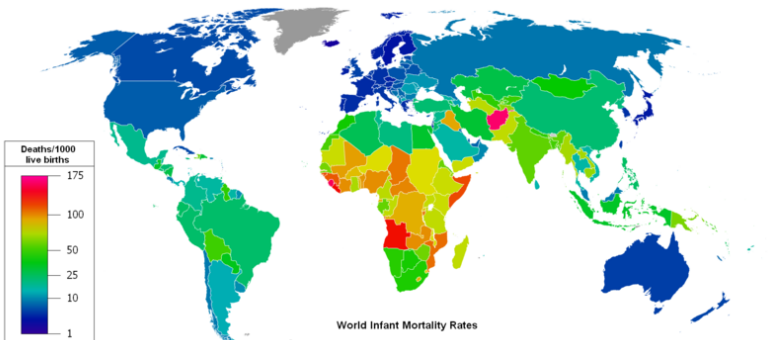
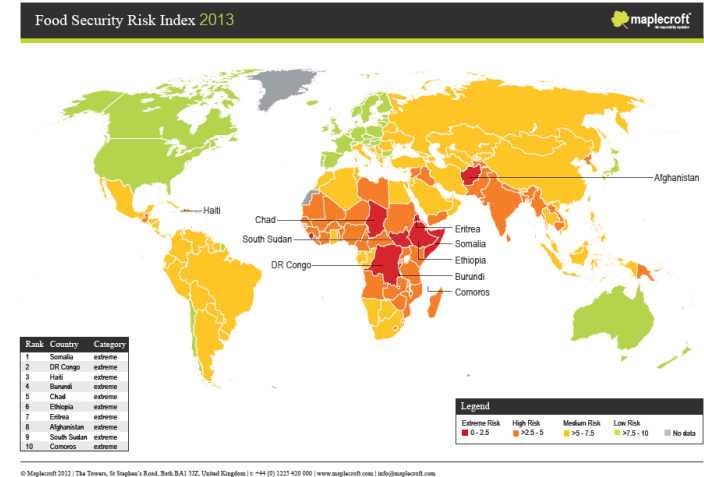
- Gini coefficient is a metric of income inequality within a geographic region or nation-state – the larger the value, the greater the inequality/wealth stratification (values range from 0 to 1)
- <http://chartsbin.com/view/21795>
- Many poor countries (and some rich countries) are also profoundly stratified
- The total population living in poverty is a function of both total national income and stratification
- US among the most stratified of affluent nations
- <http://www.ophi.org.uk/multidimensional-poverty-index/mpi-data-bank/mapping-the-mpi/>



2009 map of proportion of population living on less than \$2/day

Other factors associated with poverty

- Shorter life expectancy
- <http://www.worldlifeexpectancy.com/world-life-expectancy-map>
- Higher rates of malnutrition and greater challenges with food security
- Higher rates of infant mortality
- Lower rates of literacy
- Total fertility rate – in many cases linked with culture of patriarchy
- Not all indicators match – some regions do markedly better in one area than another



Consequences of inequality on adaptation

- While factors beyond wealth matter, vulnerability has a great deal to do with wealth
- In highly stratified societies, or when negotiating international adaptation initiatives, differentiated impacts can create emotional distancing, limited sense of community and tension
- What are the moral/ethical obligations of the world's wealthy to invest in fairness for the global and national poor (even if there is no capital return on investment)?
- Are most people (in the US) even aware of the scale of inequity and/or vulnerability that exists in some regions?
- Intersection of adaptation and capitalism is difficult: adaptation is about taking proactive steps to avoid future losses, while capitalism champions acting in the short term to maximize current gains
- Psychology of long term versus short term thinking
- Psychology of self interest versus collective justice/responsibility

Local Initiatives in the US

- Can target any number of a range of issues
 - Flooding (both riverine and coastal)
 - Drought risk
 - Wildfire risk
- Local initiatives can form from grassroots leadership
- And/or can be government sponsored on a range of different levels
- <http://njadapt.rutgers.edu>
- <http://www.georgetownclimate.org/adaptation/state-and-local-plans>
- <http://www.climatechange.ca.gov/adaptation/strategy/>

Local Initiatives internationally

- Local scale adaptation can be organized and initiated in a range of ways; grassroots organization, government initiation, some combination of both
- Often most effective in places with a strong sense of community
- Sometimes (but not always) less effective in affluent cities where people tend to not know each other
- Green Wall of Africa to combat desertification (envisioned internationally, but implemented locally)
- Conservation efforts in Latin America
- Community flood management in Bangladesh; communities will often stockpile emergency supplies on large mounds, so they can be more resilient when the flood waters come

US national initiatives

- Part of US Federal Climate Change Initiative
- <http://www.whitehouse.gov/administration/eop/ceq/initiatives/resilience>
- <http://www.epa.gov/climatechange/impacts-adaptation/fed-programs.html>
- Better internal government partnership and government-stakeholder information sharing
- Enabling adaptive learning
- Enabling better preparedness planning
- Support climate resilient investment
- Better management of land, water and infrastructure

National initiatives in other countries

- For nations party to the UNFCCC, National Adaptation Programs of Action (NAPAs) have generally been submitted
- Adaptation needs are highly differentiated across nations because impacts are highly differentiated across nations
- Semi arid to arid countries need to focus on desertification risk
- Areas prone to cyclones need to focus on those risks
- Arctic nations and communities need to adapt to rapid loss of sea ice and permafrost
- Low lying and coastal nations (especially the Maldives and Tuvalu) may simply need to work on some international collaboration to enable large scale migration in light of rising seas (in addition to hard and soft engineering responses to the rising seas)

International initiatives and commitments

- Cancun adaptation framework grew out of 2010 COP in Cancun: hinges on five pillars
 - Implementation
 - Support
 - Institutions
 - Principles
 - Stakeholder engagement
- <http://unfccc.int/adaptation/items/4159.php>
- Through the COP system, there is some limited transfer of funds to adaptation activities through the CDM and there is a separate climate adaptation fund to which developed nations have some commitment
- Part of developed world responsibility is arguably to help foster adaptive capacity and technology transfer (for both adaptation and mitigation technologies)
- Generally, because of the differentiated national interests, the scale of global adaptation financing is rather small in comparison to the need

Globalization and global environmental change: double exposures

- Premise of “double exposure” developed by Robin Leichenko and Karen O’Brien
 - Premise is that many of the people who are most vulnerable to adverse economic consequences from globalization are also most vulnerable to adverse consequences from global environmental change
1. *Outcome double exposure*: Overlapping outcomes of climate change and globalization – *linked to increasing inequalities and vulnerabilities*
 2. *Context double exposure*: Exposure and capacity to respond to each global process is shaped by exposure to the other process – *vulnerability and resilience are dynamic*
 3. *Feedback double exposure*: the outcomes of one process drive the other process – *negative and positive synergies between the two processes*

Outcome double exposure: financial crisis hit amidst drought

Drought Adds to Hardships in California



Heidi Schumann for The New York Times

A farmers'-market-style food handout at Valley Life Community Church in Selma, Calif., helps many families. [More Photos](#)

By JESSE McKINLEY

Published: February 21, 2009

MENDOTA, Calif. — The country's biggest agricultural engine, [California's](#) sprawling Central Valley, is being battered by the recession like farmland most everywhere. But in an unlucky strike of nature, the downturn is being deepened by a severe drought that threatens to drive up joblessness, increase [food prices](#) and cripple

- Epicenter of US housing market collapse
- Drought is symptomatic of climate change

(Leichenko et al. 2010)

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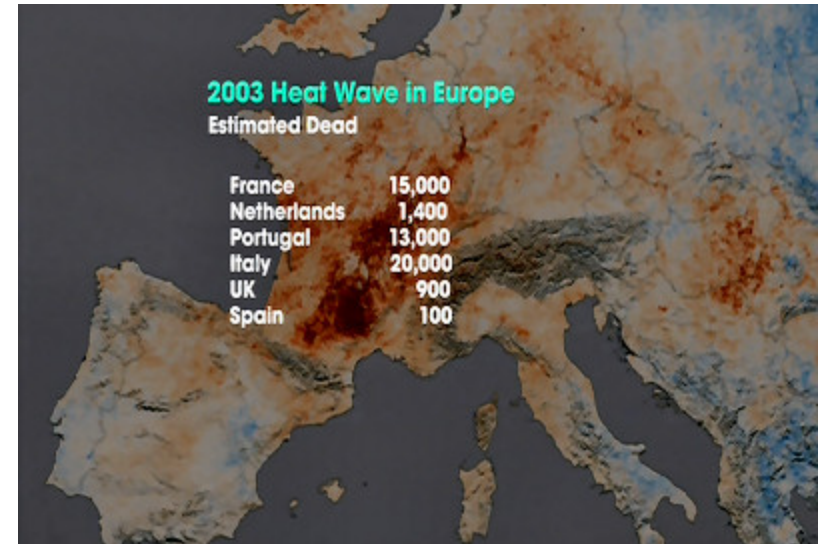
HOW SUMMIT

Context double exposure: loss of urban resilience under neoliberalism

Disappearance of social safety nets and vulnerability to urban heat waves

Expansion of marginal housing and vulnerability to flooding

Weakened social institutions and vulnerability storms



http://staffwww.fullcoll.edu/tmorris/an_inconvenient_truth/heat_wave_europe_2003.jpg



Feedback double exposure: synergies between globalization and climate change create new opportunities

- Green jobs, alternative energy, water conservation
- Global markets for carbon and ecosystem services



[http://
www.resourceactionprograms.org/
blog/wp-content/uploads/2009/02/
brightsource.jpg](http://www.resourceactionprograms.org/blog/wp-content/uploads/2009/02/brightsource.jpg)

Outcome measures within different climate change discourses

Biophysical: forest cover, crop productivity, species divers., water qual., income, population levels

Human Environment: livelihood diversity, ecosystem resilience; sustainability

Critical: income distribution, access to resources, gender equity, poverty

Skeptical: Will use biophysical measures, but will draw different conclusions

Adaptation, social justice, and race

- Climate is a social justice issue – do wealthy people (in the global scheme of things) have a right to continue contributing to emissions at a rapid scale when many of the poorest will bear the largest impact?
- It is a racial issue, both internationally, but also intra-nationally because of pre-existing socioeconomic divisions within and across societies
- Double exposures framework would tend to argue that the existing biases and inequities may be reproduced and exacerbated in light of climate change



AP / Houston Chronicle, Brett Coomer

Adaptation, social justice and feminism

- Climate change is also a gendered discourse – especially in severely patriarchal lower income countries where women do much of the work of tilling crops and gathering water
- Will climate change impose that much more labor on or impart that much more disadvantage to women cultural reasons?
- Will there be additional risks of violence or disease for women in a more climate stressed world?
- Will women's voices be solicited or even heard in planning adaptation responses at the community or larger scales?
- Will the interests/needs of women and children be adequately served if most of the decision makers are men?
- <http://www.wedo.org>



The need for adaptation

- Because of committed warming and the forces of globalization pushing towards higher emissions, there is great need for proactive, anticipatory adaptation measures
- The more mitigation is delayed or not engaged, the more adaptation is needed and vice versa
- As with alternative energy, there are many good reasons to pursue adaptive responses even if one does not accept the premise of anthropogenic climate change
- we are often poorly adapted to the disasters we face at present
- So even if there is no acceptance of the premise that climate change may imply an increase in the hazard or that demographic changes are elevating the exposed population and vulnerability, one has to wedge one's head firmly in the sand to argue that there is not more need for adaptation at present

The limits of adaptation

- Are there fundamental limits to adaptive capacity?
- Financial limits to dealing with disaster damage
- Medical limits to dealing with extreme mortality and morbidity from a climate related disaster
- Physical and/or geopolitical limits in the case of complete inundation of islands or low lying areas
- Climate migrations – how will the issue be managed?
- Climate refugees?

Immediate response to disaster

- Humanitarian aid workers need to know where to expect crises so they can mobilize quickly
- Given the clear, understood connections between specific natural disasters and human impacts (injury, illness, homelessness, hunger, dehydration), a nimble response to crisis is essential for saving lives
- Most useful kind of information for humanitarian and disaster responders is generally high quality seasonal to storm level forecasts
- But some reflection on long term trends should inform longer term investments and government/aid responses
- International Federation of the Red Cross is very interested in cutting edge seasonal forecasting to inform response decisions
- <http://www.climatecentre.org/site/about-us>

Engineering approaches

- Hard structures
 - Sea walls, levees, groins
 - Beach nourishment
 - Protected infrastructure
- The problem with hard structures is that they will eventually fail and when they do, the disaster will often be greater
- Cloud seeding in the case of drought
- “Softer” structures/planning adaptations
 - Reducing low lying coastal exposure
 - Parks along riverfronts
 - Forestation or planting vegetation to combat desertification



Policy/political approaches

- Proactive/reactive
- Political time scales are short, geophysical time scales are long
- Long term protective investment may require a lot of money and commitment when risk is not apparent – so even though adaptive policies make a lot of sense rationally, they are often politically unpopular
- Political discourse often in conflict with sober assessment of risk: risky behavior incentivized because of perceived economic gain and need to respect individual freedom (even at collective disadvantage)
- Fundamental fairness issue – should those who choose to live in less risky areas have to subsidize risk management for those who choose to live in more risky areas?
- Fundamental fairness issue – are adaptive responses in risky areas intended to benefit the wealthiest (who often choose to live in risky areas) or the most vulnerable (who often have limited choice)
- Bureaucratic red tape and institutional incompetence – during Katrina, there were a slew of buses that could have been used to rescue poor people who didn't have cars from challenged neighborhoods in advance of the storm
- There was not plan in place to mobilize the buses in advance of the storm and the buses were left in a part of town that was inundated
- Idiotic policies – in 2012, North Carolina passed a law forbidding coastal developers from considering the most current (and disturbing) scenarios of sea level rise in their coastal development plans
- <http://abcnews.go.com/US/north-carolina-bans-latest-science-rising-sea-level/story?id=16913782>

Financial approaches

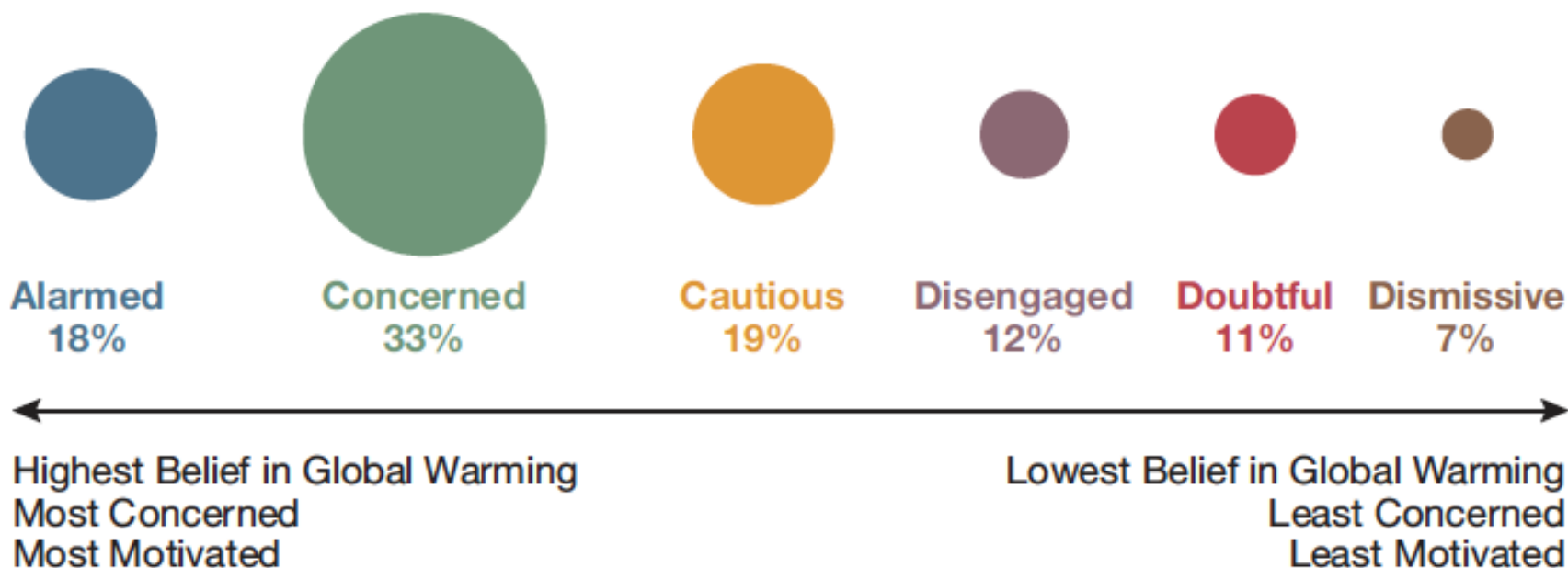
- The UNFCCC estimates that something on the order of 200 billion USD/annum should be invested in mitigation and several billion USD/year on adaptation (although the latter is much less certain)
- Even though the need for adaptation is great, the committed funding is as yet far short of meeting the need
- Investing in alternative energies can be consistent with capitalism and can return a profit
- While many studies show that anticipatory adaptation investments can dramatically reduce losses, most adaptation measures do not generate profit per se
- Adaptation financing can happen on a range of scales
- Outright aid
- Investments targeted at resilience
 - Farmer loans to help with fertilizer or adapted crop varieties
 - Targeted investment to help a city protect critical infrastructure
- Insurance that incentivizes protective measures
- It should be noted that many existing financial institutions actively incentivize maladaptive behavior – eg. in several ways the National Flood Insurance Program encourages people to live in flood prone areas and is now in a difficult position financially
- Adaptation Fund:
https://unfccc.int/cooperation_and_support/financial_mechanism/adaptation_fund/items/3659.php
- <https://www.adaptation-fund.org>

Perception of climate responses and personality type

- Fatalists – we're all screwed anyway, what's the point? (isn't this rather self-defeating?)
- Heirarchists – we can manage this if we do the right things and if the right people are in charge (but who gets to make those decisions?)
- Individualists – individual rights and responsibilities are the most important thing (but what is the right balance of rights and responsibilities?)
- Egalitarians – we can only get by if we all cooperate (but what about all the reasons why people don't cooperate?)
- Part of the disconnect between the general public and the climate science community is that many people don't have the personality type of climate scientists and perceive the findings of climate science to be judgmental

Figure 1: Proportion of the U.S. adult population in the Six Americas

Proportion represented by area



n=2,129

Climate change and the collective action problem: prisoner's dilemma

- Collective Action problems tend to be very difficult to overcome
- Mitigation arguably seen as more of a CAP and adaptation a bit more community/region specific, but there are elements of adaptation that are collective as well
- Prisoner's dilemma: two suspects are arrested for a crime allegedly committed by one of them
- If one rats the other out, the rat walks and the other gets the longest sentence
- If both rat, they both get fairly long sentences
- If neither rat, they both get very minimal sentences but still spend some time in jail
- Usually both rat, even though that leads to the longest collective time in jail and both keeping silent would have the least collective time in jail

Climate Change as a security threat

- Extreme resource scarcity can become a significant factor in shaping regional conflicts
- Extreme poverty creates vulnerability that can be exploited for geopolitical ends
- Extreme poverty can be a risk factor for terrorism
- Natural disasters can enable corrupt politicians to deepen existing socioeconomic and political divides
- Seen as a threat multiplier by some figures in the US military
- For soldiers in the field, many fatal ambushes during Iraq and Afghanistan occurred during refueling – tactical advantage to being “green”

Climate Change as a security threat

- Some argument that climate change related drought played a role in facilitating the conflict in Darfur
- Some studies show that extreme heat and certain types of climate anomalies can contribute significantly to the incidence of violent conflict/war
- There is some attribution of the conflict in Darfur, Sudan to climate change – extreme drought and water scarcity brought populations into life or death competition over the same resources
- <http://www.audubonmagazine.org/articles/climate/darfur-first-climate-war>
- This whole topic (both with regard to Darfur and more broadly) is strongly debated
- <http://www.scientificamerican.com/article/can-climate-change-cause-conflict/>
- Can the mishandling of a climate crisis be then used to incite violence?
- Do climate related issues also encourage crime?

Mitigation/Adaptation Synergies

- Some activities serve both purposes
 - Forestation can mitigate by sequestering carbon and can adapt by reducing erosion and improving local water supply
 - Green roofs in cities can mitigate by sequestering carbon and increasing rooftop albedo and can adapt by keeping the building temperature cooler (reducing risk of heat stroke) and by reducing intensity of storm water flow in cities
 - Biochar – can mitigate by sequestering carbon and can help boost soil fertility
 - Parks can serve as a buffer for storm surge and can sequester carbon
- Addressing the one does not negate the need for the other
- Policies can be complementary – should not be viewed through a zero sum, either/or framework