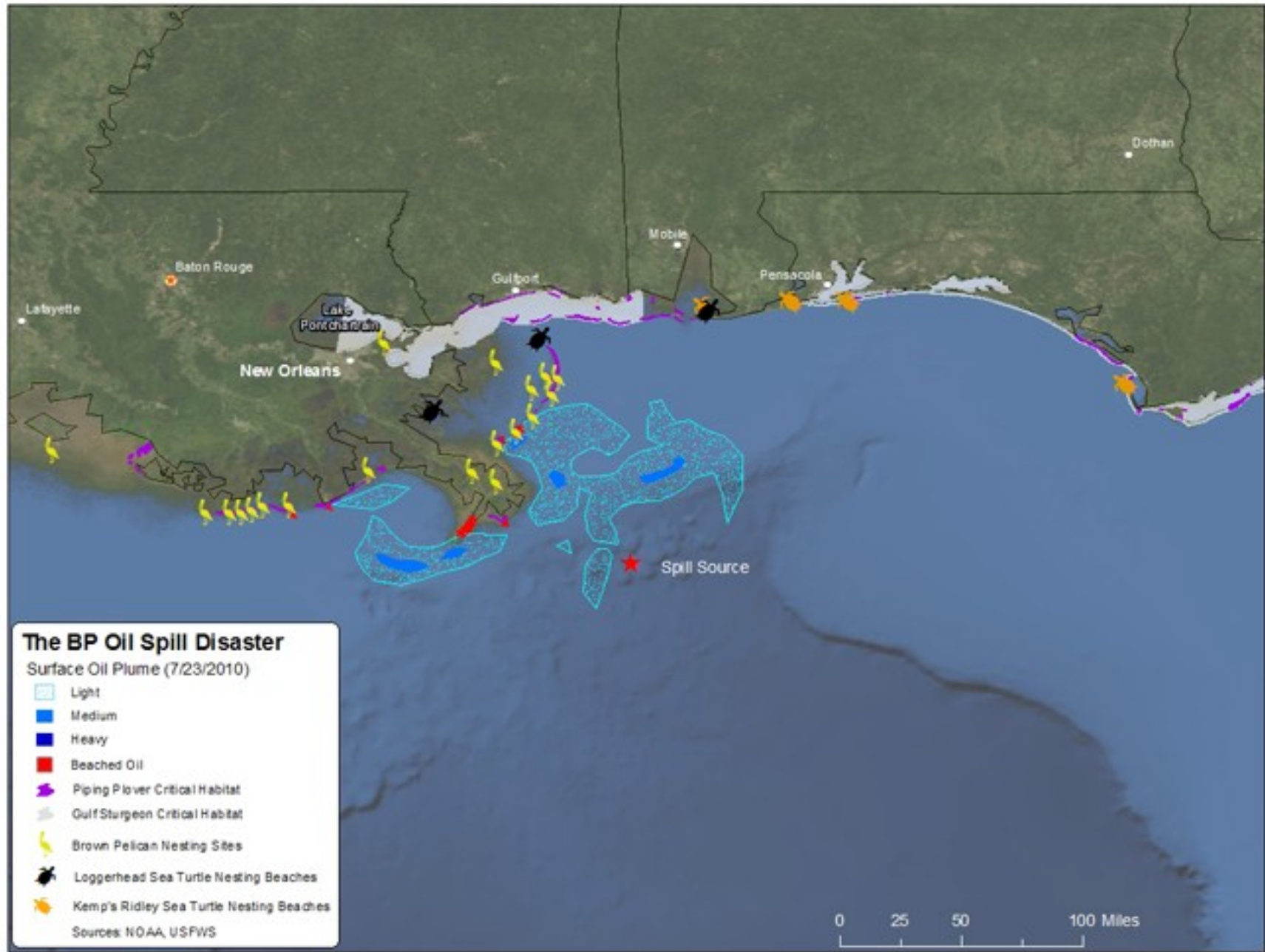


Some chemical and biological implications of the 2010 Deepwater Horizon oil spill

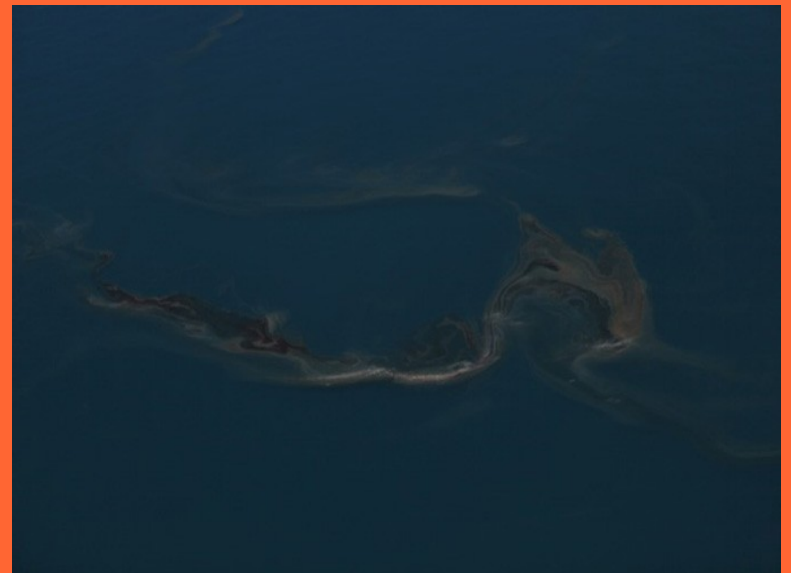
14 December 2011



U.S. Coast Guard graphic, July 2010

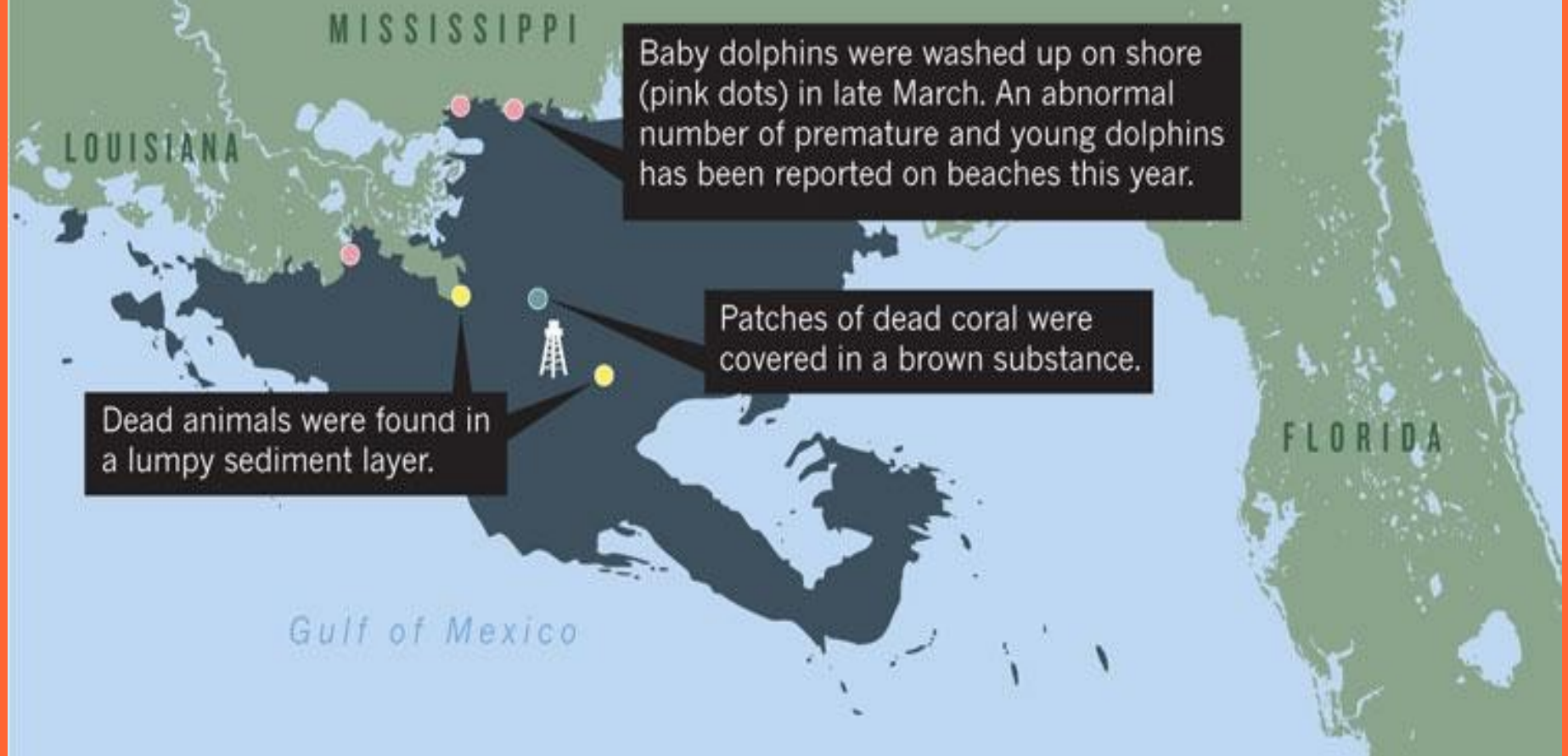
An overview of the disaster

- 20 April 2010 explosion on BP's Deepwater Horizon installation killed 11 workers
- Until capped on 15 July 2010, the spill released 206 million gallons of petroleum (4.9 million barrels) as well as 303,000 tons of natural gas
 - average rate of 2.6 million gallons/day
- 1000 miles of shoreline 'oiled'
- BP's strategy: to use containment booms, 'controlled fires,' dispersants
 - 1.9 million gallons of Corexit 9500 and 9527 used
- Much ecological damage done to this highly biodiverse region, but most in deep-sea biome
 - human-health impacts significant as well



THE BIG STAIN

The oil slick moved around day by day, but estimates of the cumulative footprint range from 120,000 square kilometres (shown in grey) to 176,000 square kilometres (8–12% of the gulf).

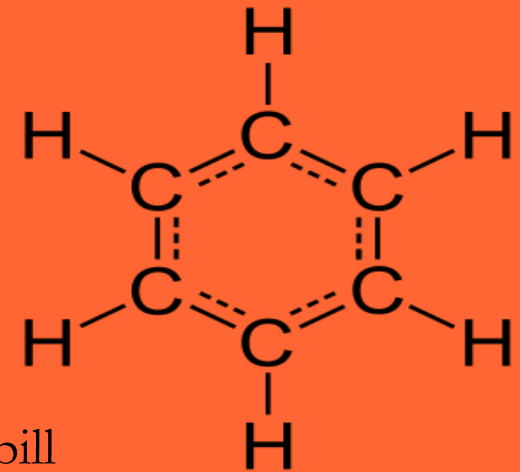


(@ Nature)

Marine biologist Samantha Joye: significant oil deposits found in 2900 km sq.; concentrated plume at depth of 1.1km 35 km in length

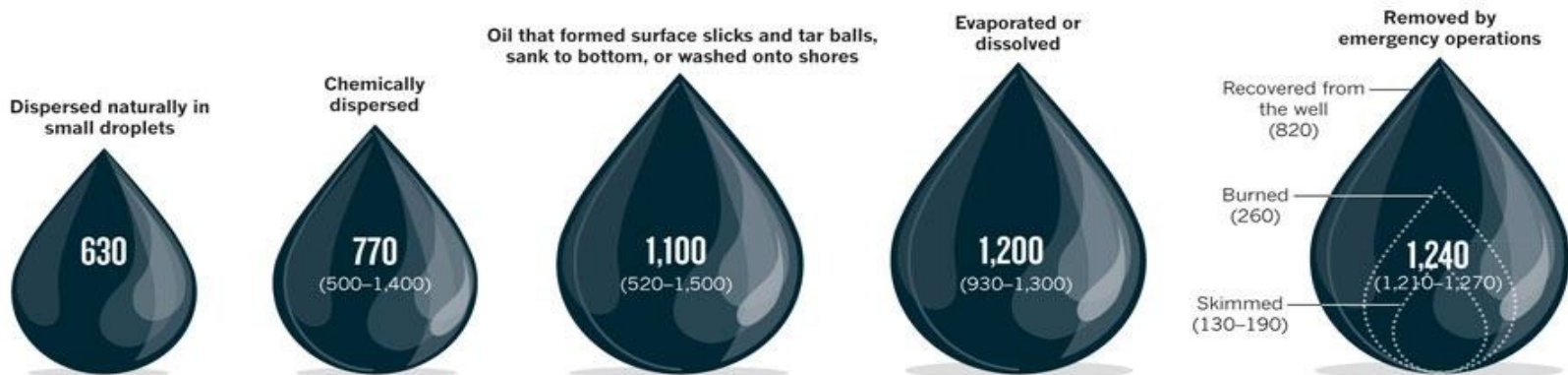
Chemical implications of mass-petroleum release into the Gulf environment

- direct suffocation/smothering
- destruction of habitat
 - e.g. Queen Bess Island (pelicans)
- oil-consuming microbes creating anoxic environments
 - Joye: O₂ drops of 30-35% in certain areas affected by spill
- release of carcinogenic benzene as oil is broken down
- worse effects through synergy with dispersants



WHAT HAPPENED TO THE OIL?

During the Deepwater Horizon crisis last year, the US government estimated where the 4.9 million barrels of oil went so it could plan response efforts. In November, it issued revised numbers, as well as ranges for some categories (shown in parentheses). All numbers are in thousands of barrels.



(@ Nature)

Chemical implications of dispersants

- Two used (both banned in 19 countries): Corexit 9500 + 9527
- Employed both on surface (est. 1.84 million gallons) and below surface (est. 77,000 gallons)
 - this latter for first time in history!
- Idea of dispersants: to break petroleum into microdroplets more easily consumed by hydrocarbon-consuming microbes
- When combined with oil, found to damage insulating properties of feathers of seabirds (hypothermia) as well as be fatal to embryonic zebrafish (Ed Stellwag) and hinder development of corals (and so reefs)
- Contains 2-Butoxyethanol, which is associated with hemolysis, kidney/liver damage given “repeated or excessive exposure” (MSDS of manufacturer)
- consideration of bioaccumulation

Observed effects on wildlife

- Spill occurred in spawning season for many species
- CBD: deaths of 6,104 birds, 609 sea turtles, and 100 marine mammals directly attributable to oil spill
 - vast underestimate
- “more than 82,000 birds; about 6,000 sea turtles; nearly 26,000 marine mammals, including dolphins; and an unknown, massive number of fish and invertebrates may have been harmed by the spill and its aftermath” (CBD)
- 2010 worst oyster harvest on record (approx. 50% of usual): expected 100% mortality of W. Mississippi Sound
- shrimp fishing similarly impacted, as spawning grounds near to site
- jellyfish blackening
- Corexit found to interfere with sea turtles' respiratory, excretory, and digestive systems and to inhibit egg-fertilization in birds



Human-health implications

- Besides economic hardship and psycho-social (existential) disturbance, the the course of the spill has had serious health impacts on human populations residing on Gulf coast
- Corexit: long-term adverse neurological effects on children and fetuses; associated with CNS damage, organ failure, asthma, and other respiratory conditions; linked to hereditary mutations; found to cause chromosomal damage to DNA of cleanup workers, leading to increased susceptibility to cancer (Spain, 2002); conditions experienced among workers responding to disaster similar to those of workers who worked to remediate the Exxon-Valdez spill (Corexit also used in that case)
- Dr. Mike Robicheux (MD): thousands exposed to toxic contaminants who could die without treatment
 - question of health-care access as well

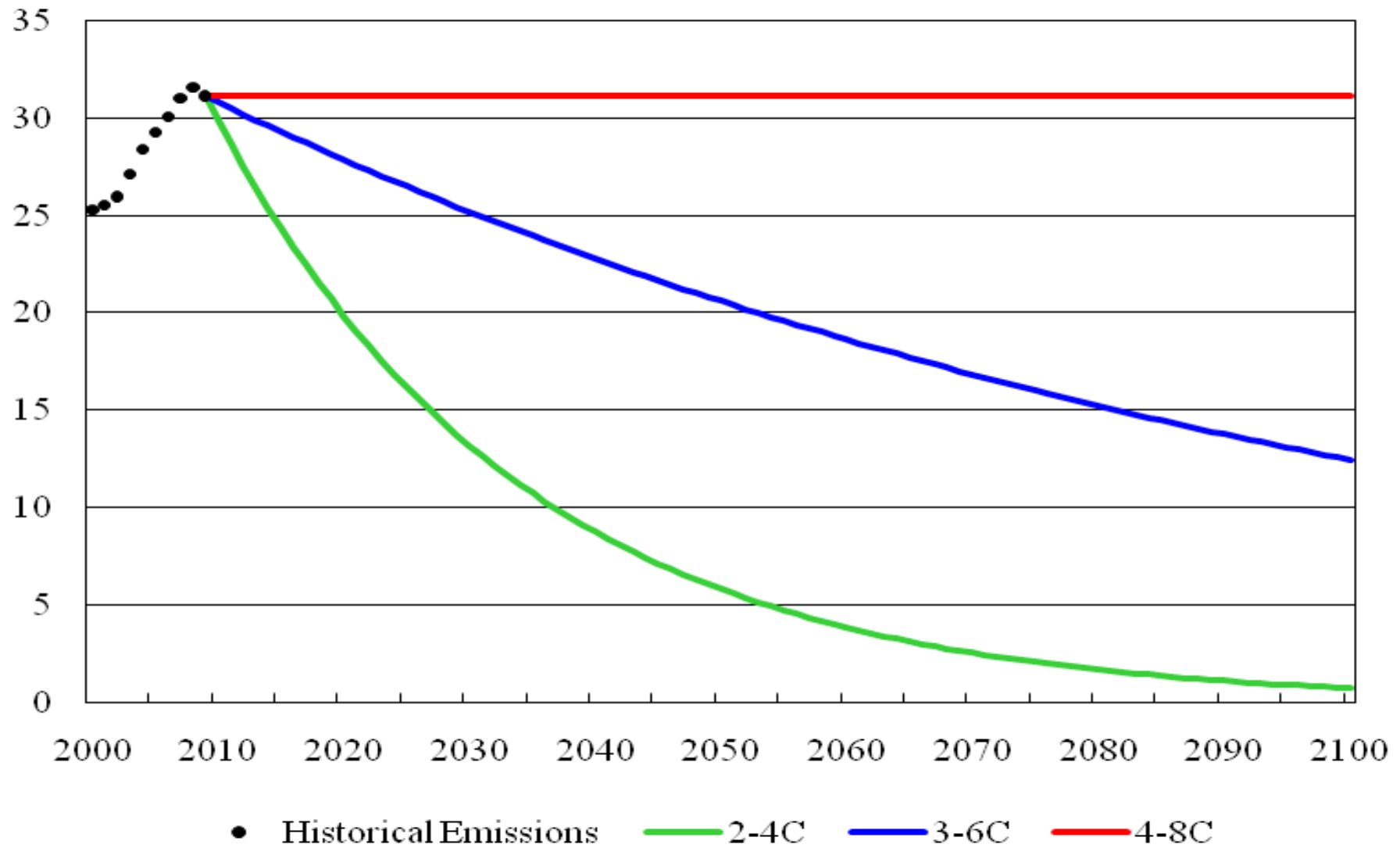
The disaster's relationship to climate catastrophe

- As is self-evident, fossil-fuel combustion exacerbates (causes) anthropogenic climate change due to heat-trapping characteristics of CO₂
- Oil-extraction from sites like the Macondo well underpin and drive global capitalism (particularly living standards of overdeveloped Northern societies)
 - Nigeria, Sudan, Middle East
- A question of equity, justice, sanity



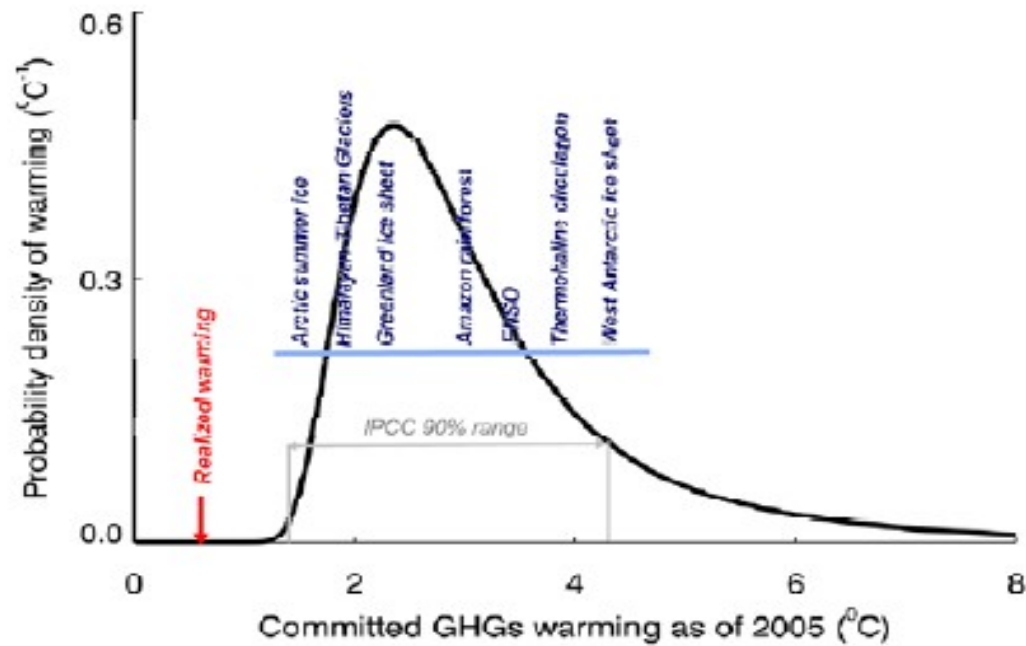
((@ Manish Swarup/AP)

World Carbon Dioxide Emissions from Fossil Fuels (Billion metric tons, 2000-2100)



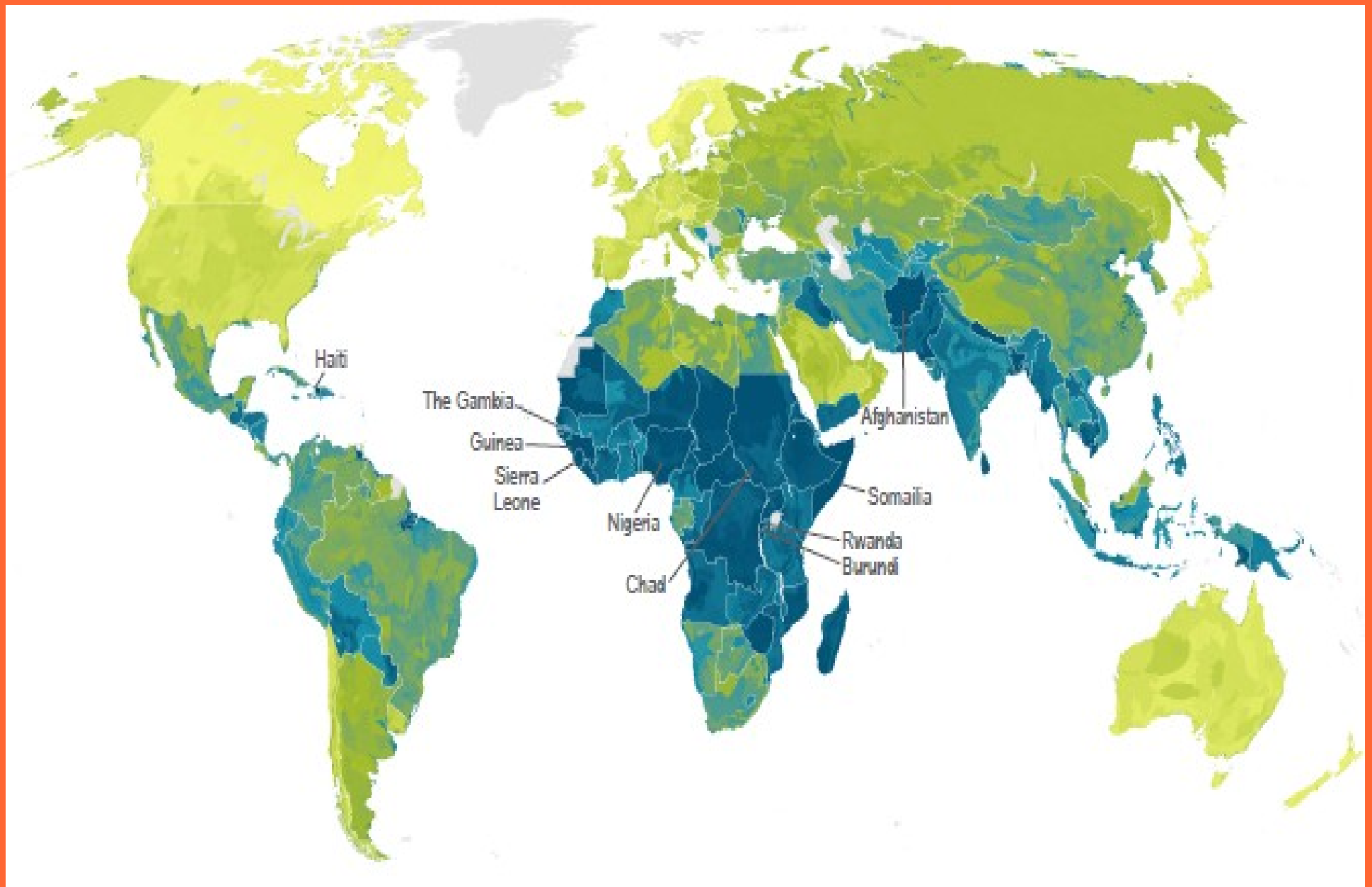
Minqi Li, "China, peak oil, climate change"

Dangerous Warming Commitment

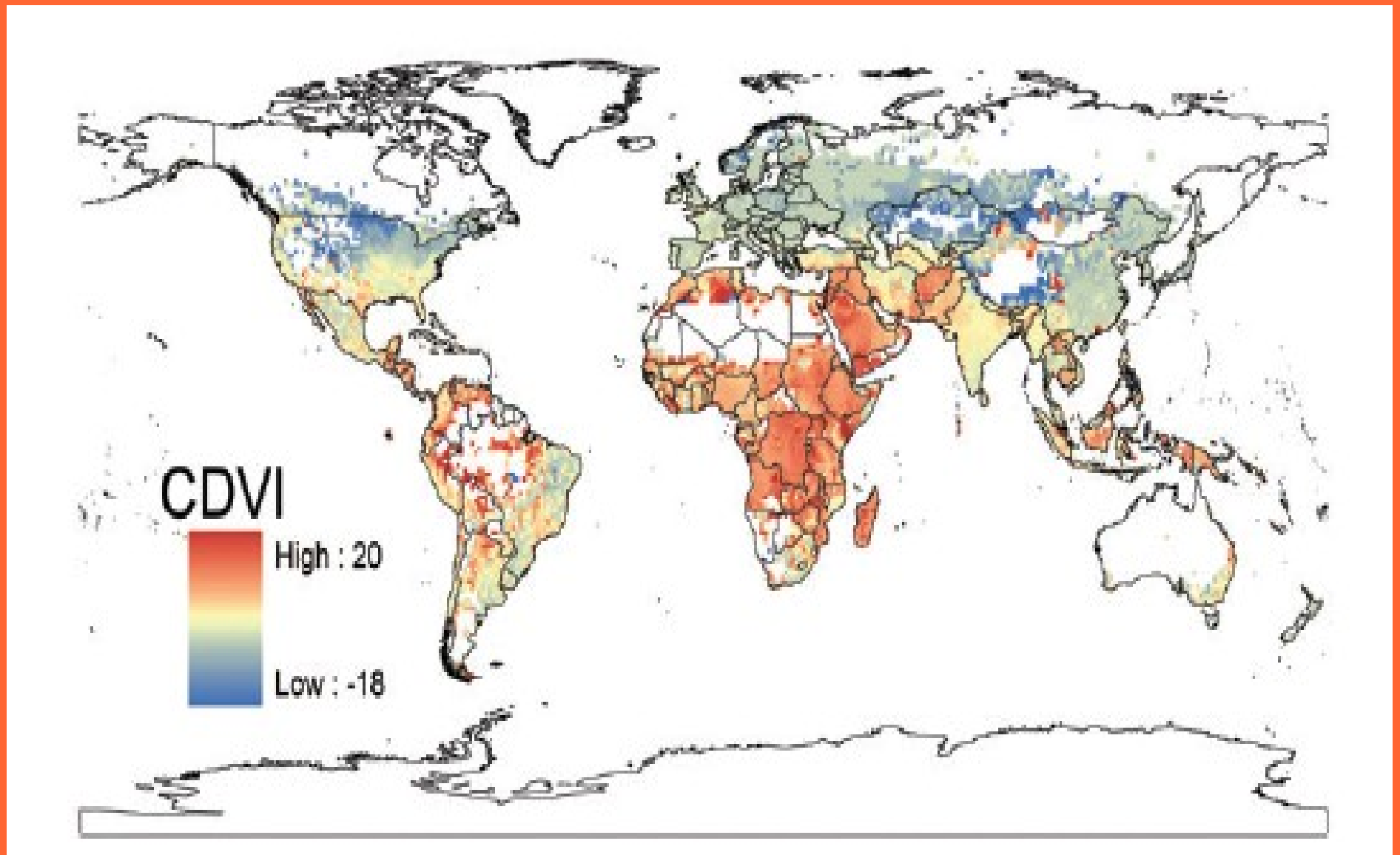


(Ramanathan & Feng 2008 PNAS)

from Joachim Schellnhuber, "Terra quasi-incognita"

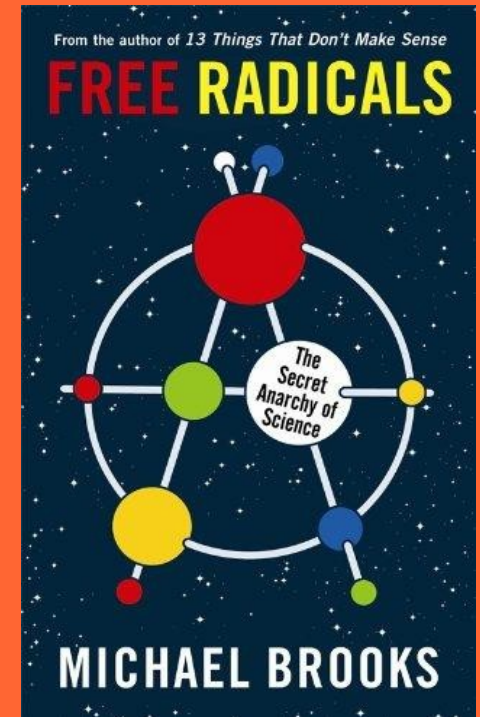
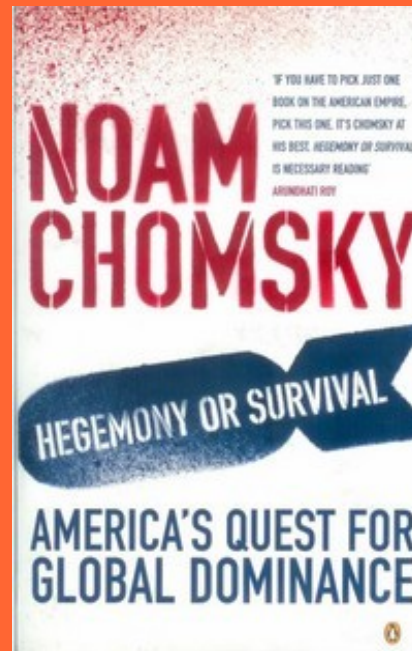


Maplecroft's "Climate Vulnerability Index 2009-2010"



from J. Samson et al., “Geographic disparities and moral hazards in the predicted impacts of climate change on human populations” (2011)

Barbarism or freedom?



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