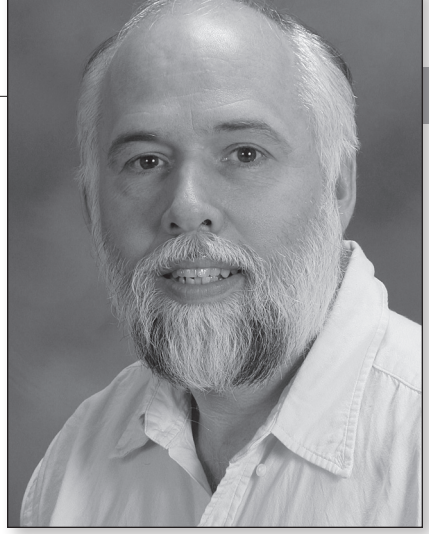

By Craig M. Pease

Drought, Flooding, and Fossil Fuels

Drought in California. Flooding in Texas. Too little water here. Too much water there. Exemplars both of ongoing dramatic increases in the frequency and impacts of "natural" disasters worldwide. Herewith, the science is certain, and provides a manifold explanation to the causes of global disaster.

In the last several decades, carbon dioxide levels caused by burning fossil fuels, have increased from 340 parts per million to 400 ppm, causing the Earth's average temperature to increase by about three-quarters of a degree Fahrenheit. Increased temperatures cause more surface water to evaporate into the atmosphere, thereby increasing the amount of water vapor (itself a greenhouse gas) in the atmosphere. Hot things contain more energy than cold things. Storms in a hot atmosphere necessarily dissipate more energy, and hence cause more damage.

Over the last several decades, human population has increased at 1.5 percent per annum, roughly from 4 billion to 7 billion. Perhaps not as widely known, global per-capita economic activity — driven primarily by increased burning of fossil fuels — has increased faster than population growth, at about 1.8 percent per year, from about $7,000 to $12,000 per capita.

Because of this ongoing population and economic growth, humans and our economic infrastructure now broadly cover the terrestrial surface of the Earth. Hard numbers are here somewhat elusive, but the human footprint literature offers some insight. As measured, for example, by net primary productivity coopted by humans and human versus natural land use, I think it is fair to say that people now occupy, roughly, about 50 percent of the biosphere.

More carbon dioxide in the atmosphere. More water in the atmosphere. Higher temperatures. More energy dissipated in storms. More people. More economic activity for each person. Earth's habitable land now ubiquitously covered by humans and their economic activities and infrastructure. It would be astonishing if all this had not caused a dramatic increase in the frequency and costs of droughts, floods, and other disasters.

But this story is not just about fossil fuels. It is also about water.

Each person in the United States uses just over 1,500 cubic meters of water each year, including household use, industrial use, and agriculture. Humans eat plants, and we also eat animals that themselves eat plants. Plants capture the energy in sunlight in photosynthesis, a chemical reaction that, critically, consumes lots of water.

Water and oil do not mix, especially when it comes to public policy

Though both are critical to modern societies, the contrast between fossil fuels and water could not be more stark. Fossil fuels contain high amounts of energy, and weigh relatively little. Water, by contrast, typically has no useful energy content (ignoring special situations such as hydroelectricity) and is heavy. Fossil fuel reserves are concentrated at narrow spatial locations. Fresh water is distributed across the landscape in a less concentrated, though still far from uniform, manner. These fundamental differences have led to fossil fuels and water being controlled by qualitatively different institutional regimes.

Fossil fuels reserves, transportation, refining, and sales are, in the United States at least, by and large owned and controlled by private individuals and for-profit corporations (acknowledging substantial reserves found on public land, then extracted and sold by private companies). Fossil fuels can and are regularly owned, for example as mineral rights. The very feature of fossil fuels that makes them especially valuable economically, and especially as a transportation fuel — high energy density — also makes them well suited to private ownership, control, and exploitation.

Water is an archetypical public good. Because water is so heavy, it cannot be economically shipped by rail, truck, or ship (save for the inconsequential amounts sold as bottled water). We use massive amounts of water. But the economic value of each gallon is low. Water for California farms costs less than one cent per gallon, whereas oil costs over one dollar per gallon. To move water from where we have too much to where we have too little, in a way that keeps the cost of transportation economically viable, we need to build and maintain public infrastructure, for example the California State Water Project. Water found on private property is typically not owned. Rather, its use is controlled with an arcane and archaic web of institutions (e.g., prior appropriation doctrine), which bear more similarity to the strictures of medieval vassal-serf relations than to modern property law.

The droughts and flooding we now witness are artillery rounds of a titanic battle between the institutional regimes controlling fossil fuels versus water. The carbon dioxide produced by burning fossil fuels now threatens our water supplies. We best negotiate a truce. The damage will only continue to escalate.

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