

A Chronicle of the Age of Consequences

Chapter 12 A Dry Run

In late March, while returning home from Spring Break with my family, I drove smack into the Age of Consequences.

It happened a few miles west of Winslow, Arizona, in a desolate and lovely stretch of country called the Painted Desert. We were zooming along the Interstate, singing songs, when suddenly I saw a dirty brown cloud on the horizon. At first, the tempest looked minor – maybe the trailing dust from a herd of pick-up trucks coming off the Navajo reservation or a mischievous dust devil of unusual size and naughtiness. But as we drove, it kept growing. Soon, Gen noticed it and a few moments later the singing stopped. The cloud was *huge*. Towering. Angry brown. Gen and I conferred, but before we could make a decision we were engulfed by a dust storm straight out of *Lawrence of Arabia*.

It wasn't *that* bad, of course, though it went on for miles. I turned the truck's headlights on, slowed down and gritted my teeth. As good westerners, we never seriously considered pulling off the road. Instead, we urged our faithful horsepower forward, determined to fulfill our modern manifest destiny to get home by suppertime. The kids thought the swirling dust was great fun, and when we emerged out the other side, unnerved but undamaged, they urged us to turn around and do it again.

Miles later, I was still unnerved. I couldn't shake an ominous feeling that had come over me in the middle of the tempest. In forty-odd years of criss-crossing the American West, driving hundreds of thousands of miles, including countless back-and-forths on this particular stretch of Interstate 40, I had *never* encountered a dust storm such as this one. Not even close. It wasn't just bad luck either. Though the West is a dry place, subject to periodic droughts that can loosen dirt and send it flying without too much effort, it is not known for its Dust Bowl-like maelstroms. Something was wrong. This had to be a sign.

It was.

A week or so after our little adventure, our newspaper ran a front-page story by the *Associated Press* about a different, but no less ominous, dust storm. This one struck Silverton, Colorado, on April 3rd, turning two-feet of snow on the ground a rusty red. This was news not only because Silverton, at 9300 feet in elevation, sits at the evergreen heart of the San Juan mountains and doesn't normally look like the surface of Mars, but because, according to reporter Juliet Eilperin, it portends all sorts of trouble.

For starters, dust speeds up snowmelt – because its dark color absorbs heat – which can create a myriad of downstream consequences, including too-early runoff for plants, wildlife, farms and people. Second, dust is a sign of drought, especially when it comes in big blasters, racing across large landscapes – the product of too little rain and too much human-caused disturbance.

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The source of this dust is debatable, according to Eilperin, and thus, because this is the West, a cause for finger-pointing. Were there too many livestock eating too few grass plants and exposing too much soil to the erosive power of the wind? Were there too many off-road vehicles tearing up fragile landscapes? Was there too much oil and gas exploration blading scars across vast stretches of the dry lands? Were there too many unpaved lots and dirt roads in rural subdivisions, home to weak weeds and dust-raising SUVs? Pick your fight.

What isn't debatable, according to a recent report in the *Proceedings of the National Academy of Sciences*, is this: human-induced land degradation can make droughts worse. For instance, scientists now know that while the Dust Bowl of the 1930s was hotter and drier than a 'normal' drought, the role of human-caused land disturbance helps to explain the scope and scale of the ensuing disaster. According to the report's authors, plowing up the prairie exacerbated the heat by reducing the vegetative cover over a vast area. The resulting dust storms also affected atmospheric moisture content enough to intensify drought conditions. Misery followed. Future Dust Bowls, they conclude, could easily be repeated.

That's one reason why a Mars-red Silverton sets off alarm bells, and why I emerged from my own private dust storm with a sinking feeling in my stomach. The question isn't simply *is the Southwest getting drier under global warming?* That's largely settled among climatologists and other researchers – in fact, the region's temperatures are expected to rise by 10 degrees by 2100. I think the question now before us is this one: *are we making it worse?* And perhaps this one: *what are the consequences of our inaction?*

These aren't academic questions. Later in the spring, the *Los Angeles Times* reported that twelve dust storms have barreled into the Rocky Mountains so far this year. In contrast, only four such storms hit in all of 2003. Eight occurred in each of the past three years. This is a bad sign because forecasters predict global warming will reduce the soil quality across the western United States to Dust Bowl levels by 2050, said Jayne Belnap, a scientist with the U.S. Geological Survey.

"It's just a harbinger of the future," Belnap said of the storms. "This is the kind of world we need to imagine we're going to be living in and decide if we can afford this dust."

In other words, the general alarm shouldn't just be about the rate of greenhouse gas emissions – the focus of most media and policy attention these days – it should also be on how we manage the surface of the planet.

Alarm bells are ringing in California as well. On February 27th, governor Arnold Schwarzenegger declared a drought state-of-emergency throughout the Golden State – a consequence of three straight years of below-average rain and snow. He urged urban water agencies to reduce water use by 20%. "This drought is having a devastating impact on our people, our communities, our economy and our environment," he said in a statement. Agriculture losses could reach \$2.8 billion and cost 95,000 jobs. Reservoirs are at their lowest levels since 1992. Severe restrictions could be next, including mandatory water rationing and reductions if water reserves don't improve soon and residents fail to conserve on their own.

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In Los Angeles, Mayor Antonio Villaraigosa has already accelerated water use restrictions, warning “Water shortages are becoming permanent realities.”

Drought isn’t new to California, of course. Gen and I were living in Los Angeles when the previous dry run shook the state from 1987-1992. We followed its progress through the headlines: first, the rangelands dried out, then the timber stands withered, then the shallow springs and wells stopped flowing, then the wildfires exploded (as they did in the hills of southern California during 2007-08). California squeezed through this earlier crisis mostly by: (1) managing its water supply effectively via its extensive network of reservoirs and inter-regional delivery systems; and (2) praying for rain.

But this time, the drought appears to be deeper. It is unusual, for example, for northern California, which is more heavily forested and wetter than the rest of the state, to experience three years of below-average precipitation. In other words, it is *very unusual* for the whole state to endure a big drought all at once.

Also, it’s not 1987 anymore. In twenty years, the Golden state’s population has zoomed from 28 million to over 37 million today – and it’s projected to reach 60 million by 2050. More people mean more homes, more offices, more toilets, more everything stressing an already overstressed and aging water delivery infrastructure. Then there’s agriculture, by far the biggest water user in the state. It is feeling stressed-out as well. For example, a recent court and federal regulatory rulings protecting an endangered fish in the Sacramento/San Joaquin river delta have curtailed the amount of water that can be delivered to farmers. This has angered farmers who have turned their ire on the government agencies and environmentalists.

One traditional solution to tight water supplies has been to spend money – on new pumps, canals, dams, diversion projects and other drought mitigation strategies. Unfortunately, the state is coping with a record budget deficit, which is running as high as *\$20 billion* for the current fiscal year. This black hole is a consequence of a state-wide recession as well as the economic atomic blast that struck Wall Street last fall. The state’s budget crisis means no big steps can be taken to alleviate the drought crisis this time.

Even if the state had money, however, what would it do with it? Build more dams and canals and pumps? These things haven’t helped the state avoid the current crisis and one could argue they’ve made the effects of the drought worse. More water encouraged more growth which required more water – that sort of thing. Action, as I keep repeating, has consequences.

Take the arid southwestern part of California’s productive Central Valley, where almond-growers are resorting to desperate measures to stay in business, including cutting back orchards, spraying trees with a growth-retarding chemical, and mixing saltwater with groundwater. In the 1930s, this part of the Central Valley was desert, a product of the meager 10 inches of precipitation it receives on average per year. To solve this “problem” the federal government subsidized the construction of a massive water delivery system, which diverted Sierra Nevada snowmelt into a vast complex of canals and reservoirs. It was part of an engineering and economic marvel that increased the state’s agricultural output to \$31 billion in 2006. The federal

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subsidy made water cheap as well as steady – which encouraged the planting of thirsty crops, such as almonds, and sprawling growth in cities and suburbs – setting the stage for the current crisis.

In the West, there are two famous sayings about water: first, whiskey is for drinkin' and water is for fightin' (attributed to Mark Twain); second, water flows uphill toward money. But what if there isn't enough water *or* enough money? Both appear to be in short supply in the Golden State, which means in the next decade or so, Californians may see plenty of fightin' – especially as climate change takes hold.

Speaking of climate change, Energy Secretary and Nobel Prize Award-winner Steven Chu told a *Los Angeles Times* reporter in February “I don't think the American public has gripped in its gut what could happen... We're looking at a scenario where there's no more agriculture in California. I don't actually see how they can keep their cities going... I'm hoping that the American people will wake up.”

They ought to – the alarm bells just keep getting louder.

They're ringing in south Texas, which is experiencing its worse drought in half a century. Eighty of the state's 254 counties are officially in “extreme” or “exceptional” (the worst category) drought conditions, according to the U.S. Department of Agriculture. In April, seventy Texas counties were declared “natural disaster areas” by the federal government due to decreased rainfall, above normal temperatures, and associated wildfires. Over 200 public water systems in Texas have declared mandatory water restrictions – and even the biggest cities are feeling the pinch. Agricultural losses are already being counted in the billions. Tourism has taken a hit too, especially as lakes and reservoirs dwindle.

Dust storms in Arizona and Colorado, water shortages in California, prolonged drought in Texas – these are examples of how precariously balanced our civilization is in regard to its most precious resource: water. And the hand tipping the balance is our own.

The loudest bell, however, can be heard in Australia.

In early February – at the end of the Australian summer – devastating wildfires broke out in the southern state of Victoria. Twenty-four blazes ravaged more than 1.1 million acres of land, killing 201 people – the highest total for brushfires in Australia's history. 7500 people were left homeless. Two towns were completely wiped out. The largest blaze burned within fifty miles of Melbourne, the nation's second-most populous city.

“Wildfires are an annual event in Australia,” reported one news source. “But this year, a combination of factors has made them especially intense: a drought, dry bush and one of the most powerful heat waves in history.”

For the first time since record-keeping began, temperatures exceeded 110F for three days running in Melbourne. The low at its airport one morning was 87F. If this weren't enough bad

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news, the nation is in the grip of a record-breaking drought. The Australian Alps are enduring their driest three years in history. Water from the vast Murray-Darling river system in southern Australia fails to reach the sea 40% of the time.

According to scientists, the continent, already the driest on earth, is highly vulnerable to the effects of global warming. Most Aussies, for example, live on the continent's coasts which means they are at risk of rising sea levels (Australia emits more carbon dioxide per capita than any nation on earth, by the way).

Meanwhile, northern Australia was hit with record flooding this winter, causing outbreaks of malaria and dengue fever, the result of mosquitoes breeding in standing water. And when Darwin, the region's largest city, isn't getting slammed by rain, it's sweltering. Recently, it has endured 20 to 30 days of temperatures above 95F (with high humidity). By 2070, climatologists say, such conditions may extend to 300 days a year.

Then there's the world famous Great Barrier Reef, off Australia's east coast, which is withering under climate extremes. Higher ocean temperatures are bleaching coral and impacting fish populations. Scientists expect the Reef to become functionally extinct by 2050 under Business-As-Usual climate models.

For Australians, there is nothing hypothetical about global warming.

"All of this is consistent with climate change and with what scientists told us would happen," said Penny Wong, Australia's climate change minister, recently.

But it is in the critical Murray-Darling river system – the nation's breadbasket – that the alarm bells ring most loudly. The current seven-year drought there is the most devastating in the 117-years of recorded history, likely the consequence of a $\frac{3}{4}$ of a degree Celsius increase over the past fifteen years. But in an article for *National Geographic* magazine this spring titled "Australia's Dry Run," Robert Draper writes that the trouble is not so much a lack of water in the Murray-Darling system, which provides 65% of all the water used for the country's agriculture, but that it's been over-allocated. And farmers and ranchers are being the brunt of the disaster.

Australia is a tough nation, observes Draper, founded by hardscrabble pioneers. However, they brought old-world habits to a dry land, including the habit of clearing land for homesteading and cultivation. By one estimate, over 15 *billion* trees were cut down by settlers. This disrupted a delicate water-cycle by removing and uprooting plants adapted to arid environments. Then came sheep and cattle and the plow, all of which were employed in an old-world (i.e., wetter) management paradigm. The result was widespread soil degradation which further impacted water cycles.

It wasn't all rape and ruin, however. For more than a century, homesteaders and decision-makers refused to cross "Goyder's Line." In 1865, a surveyor named George Goyder set out on horseback to trace the ecological boundary between grassland and shrubland – the boundary, in other words, between arable land and arid land. This line was respected until the start of the 20th

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century when, with government encouragement, soldiers returning from World War I settled “across the line” and began to plant orchards and vineyards. Canal after canal was dug to deliver the Murray River’s precious water to new farmland, as well as growing towns and cities. It was a gamble, everyone knew, and for a while it seemed to work.

But when the Murray ran low, as it always does periodically, the new farm fields began to salt up. The government responded with a technological cure for this “salt problem” – pump huge amounts of fresh groundwater onto the fields. This only made the problem worse over time. The extra water encouraged speculation in profitable but water-intensive crops, including rice, cotton, and olive and almond trees. Dairy farming took off as well. Water rights became a valuable commodity which, aided by government tax incentives, resulted in the aggregation of farms into larger and larger corporate super-farms whose expansion required more and more water for their thirsty plants and animals.

In this way, Draper writes, the dry and marginally fertile lands of the Murray-Darling basin were transformed into the breadbasket of the nation through massive works projects that included dammed rivers, filled reservoirs, canals, and irrigation fields. It worked while it rained. But the rains have slowed considerably since 2002 and the precarious balancing act is now flying apart.

In fact, the current drought has fallen like a hammer-blow, quickly pitting cities against farmers, environmentalists against water managers, and small farms against corporate super-farms. Whole crops have been wiped out by heat stress and low moisture, while entire agricultural sectors, including rice, cotton, citrus, now face collapse.

It isn’t just farmers. The city of Adelaide gets up to 90% of its water from the Murray (though its claim on the river only comprises 6% of the total water use in the basin). Today, it has the dubious distinction of being the world’s first major city to live in a perpetual state of water shortage.

“In what is shaping up to be a cautionary tale for other developed nations,” writes Draper, “the world’s 15th biggest economy is learning hard lessons about the limits of natural resources in an era of climate change.”

Then there is the river itself – long a staple of Australian folklore as an emblem of the continent’s beauty and mystery. Without around-the-clock dredging at its mouth, the Murray wouldn’t reach the sea. Associated native plants and animals have taken a beating. The marshes along the river’s course take a back seat to human need. Nothing is as it was. The mythical Murray is being destroyed. “It is hard for many Australians to reconcile the sputtering, surgically disfigured version of the Murray River with the shimmering idyll of their younger days,” writes Draper.

Perhaps this is one of the reasons a Royal Commission has been appointed by the government to investigate the link between climate change and Australia’s heat crisis. Their report is due in August.

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What is the lesson of Australia's dry run? It depends on who you listen to. Build massive desalination plants, as some suggest? Develop genetically-modified crops that are drought-resistant, as others say? Or rethink rice farming in a desert? Currently, 20% of the water in the Murray-Darling basin is dedicated to rice production. But this raises another conundrum: on the one hand, producing rice in a desert is ecological insanity, but on the other, it helps to feed a hungry and growing global human population. What to do?

For Draper, the lesson of the dry run is clear: "Goyder's Line is even more relevant today, as drought and climate change give new urgency to the question of how intensively marginal agricultural land should be worked...A robust new landscape is required," he concludes, "and it's up to Australia to show the rest of the world what that new landscape will be."

For others, the lesson is global. "Australia is the harbinger of change," said paleontologist and author Tim Flannery recently. "The cost to Australia from climate change is going to be greater than for any developed country. We are already starting to see it. It's tearing apart the life-support system that gives us this world."

For whom does this bell toll? It tolls for us.

I know – I can hear it myself. In the American Southwest, where I live, we are confronted with our own "Australia." The Colorado River – our Murray – serves 27 million people and waters three million acres of farmland. And according to most experts, it's over-allocated. So what happens if climate change takes a 10% bite from snowmelt? Or a 20% bite? All current water planning models are based on the idea that the next 100 years will be like the last 100. But what if that's wrong? Worse, data shows that the last half-century was unusually wet – coinciding with the period of explosive growth. This means, according to one study, there is a 50% chance that Lake Mead could be functionally dry by 2021, leaving Las Vegas' intake pipe sucking air.

Two years ago, *Science* magazine published research that "predicted a permanent drought by 2050 throughout the Southwest." It will be compounded by high temperatures and will, under BAU, be largely irreversible for 1000 years, wrote the authors.

Of course, droughts are nothing new in the Southwest. Anyone with a passing knowledge of prehistory knows how devastating dry runs were to the Ancestral Puebloans who had to make a living in what is still today agriculturally marginal land. The list of stress caused by these periodic bouts of prehistoric drought is long: famine, large-scale displacement, social breakdown, violence, increased infant mortality, decreased physical health, and more. Drought, history teaches us, is an insidious assassin.

In his book *The Great Warming*, which chronicles the effects of the so-called Medieval Warm Period (800-1200 AD) around the globe, archaeologist Brian Fagan notes while melting glaciers, rising sea levels, and cataclysmic weather events grab the headlines today when discussing climate change, his study of the Medieval Warm Period "tells us that the silent and oft-ignored killer is drought, even during a period of mild warming."

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Prolonged aridity was widespread in medieval times and killed enormous numbers of people, he writes. We also know that 20 to 30 million tropical farmers perished as a result of droughts during the 19th century. “Now we are entering a period of sustained warming with millions of people already at risk,” he observes, “living as they do on agriculturally marginal lands, or in the case of Arizona and California, in huge cities looting water from aquifers and rivers.”

Prehistorically, survival in the arid American West depended on cooperation and, above all, on deep and hard-earned intelligence about water supplies and food resources scattered over enormous, harsh landscape. What was for Europe and the Arctic a time of relative climatic benevolence was for vast areas of the arid American West a time of deprivation and suffering, even among peoples to whom flexibility and mobility was second nature. What helped them to survive, says Fagan, was land-knowledge and opportunism. In the process native peoples learned valuable lessons that allowed them to perpetuate a way of life for thousands of years in one of the toughest environments on earth.

Fagan believes we ignore these lessons at our peril.

“We traveled through a time when, on the whole, people lived conservatively, with a good weather eye for risk,” Fagan writes. “We’re now at a point where...the costs of vulnerability are almost beyond the capacity of even the wealthiest governments to handle. The sheer scale of industrialized societies renders them far more vulnerable to such long-term changes as climbing temperatures and rising sea levels.”

Globally, archaeology offers two stark lessons for us moderns, in my opinion: first, prosperity is fickle. When it fades, as it inevitably does, whether for environmental or cultural reasons, conflict and suffering ensue. Second, often it is our own behavior that makes the difference between feast and famine, not simply the whims of the gods or inscrutable patterns of oceanic warming and cooling. Perhaps there’s a third lesson as well: when we behave arrogantly, instead of humbly, and begin to think we’re in charge of our destiny, then the consequences of our risk-taking behavior becomes exponentially worse.

“History is always around us, threatening, offering encouragement, sometimes showing us precedents,” Fagan concludes. “The people of a thousand years ago remind us that our greatest asset is our opportunism and endless capacity to adapt to new circumstances. Let us think of ourselves as partners with rather than potential masters of the changing natural world around us.”

Of course, this is easier said than done. But obviously, we must try something else – we must chart a new course. The current map we’re following is leading us to all sorts of trouble, as the alarm bells indicate.

So, the next time I see a dust storm up ahead, I’ll encourage others to think of it as an opportunity, not another excuse to point fingers. Our collective hand may be tipping the scale right now, but we can also tip it back if we want – though not to the way things used to be. Those days are gone. It’s a new era. As any archaeologist can tell you, history is replete with passing ages, era, periods, and stages. It’s just the way things go. Whether the current age – the Age of

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Consequences – is better or worse than the previous age, whether it more violent or less, richer or poorer, dustier or not...well, that's up to us.