

Dam it!

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This is written in memory of LaVon Brillhart, a dear friend to all in Dillon, Montana. Your evocative Letters to the Editor, and your kindness will be greatly missed! A few months ago, LaVon asked me how frequently I receive angry responses to my Letters to the Editor. I told him I have never received any. He was surprised, as he frequently received angry responses to his letters.

In this series, I am writing about the consequences we are experiencing, as a result of the creation of many, many dams and reservoirs throughout the USA and the world. According to the 2021 Report Card for America’s Infrastructure, there are over 91,000 dams in the USA.

In the USA, many dams were built throughout the 1900s, with many in the Tennessee Valley and in Western States, to reduce flooding in various river floodplains, and to create a reservoir of water that can be diverted to nearby farms, ranches, towns, and mining operations. In some cases, dams are used for navigation. Once a dam and reservoir are in place, it is much easier for agriculture to spread throughout the drought-stricken West, and many new towns and industries, including mining, have grown up near the dams.

About 3% of dams in the USA are built with turbines, used to create hydroelectric energy. This so-called renewable energy is considered a good supplement to fossil fuel energy. But because of the limited life-span of a dam (about 100 years for a well-constructed and maintained dam), it is hardly legitimate to think of this power source as renewable. In hydroelectric dams, the motors, gates, and pen-stocks have to be replaced every few decades, and at some point, a dam will no longer provide hydroelectric energy.

Decommissioning a dam that has reached the end of its useful life can have some environmental benefits, but it can also be an environmental nightmare. Between 2007-2009, the Milltown Dam, an earthfill hydroelectric dam at the confluence of the Clark Fork and Blackfoot Rivers, was removed, at a cost of about \$120 million. In 2000, the EPA designated the Berkeley Pit Copper mine, Silver Bow Creek, and the Clark Fork River as the largest Superfund Site in existence. Heavy rainfall in 1908 had caused flooding in Butte, which caused the release of waters contaminated with toxic metals (including arsenic and cadmium) from the tailings pond behind the open pit copper mine. The flood caused toxic sediments to contaminate the river and the riversides, killing fish and vegetation, all the way from Butte to the Milltown Dam. When the dam was removed, the EPA worked with the local communities to negotiate an affordable compromise to deal with the contaminated soil behind the dam. The compromise was that only 30% of the sediment was removed before the dam was taken down. There was no feasible way to remediate the contaminated sediments. So they were piled up along I-90 near Opportunity, Montana, creating a large and long berm that was then covered with

uncontaminated soil. The benefit is that the removal of the dam enabled trout to migrate up the stream again, and a state park was created near the dam site.

Between 2011 and 2014, two 100 year-old dams on the Olympic Peninsula were decommissioned and removed, the Elwha and Glines Canyon Dams. These earthfill hydroelectric dams had enabled lumbering to occur on the Peninsula but also had flooded the traditional lands of the Lower Elwha Klallam Tribe and prevented fish from migrating up the Elwha River. The benefits of the dam removals are that several species of salmon and trout are once again able to swim up the river to spawn. And members of the Tribe are able to resume subsistence fishing practices that have long been a part of their culture.

When you take a naturally flowing river and put a dam on it, the following events inevitably occur:

- Sediments from run-off from surrounding farms, ranches, and habitations begin to move from the land into the reservoir. Over time, those sediments build up behind the dam. Eventually, the sediments are so high behind the dam that the dam loses some of its effectiveness.
- A reservoir has much greater surface area than does a river, thus the reservoir experiences greater evapotranspiration than would the river. Thus, the reservoir starts to lose large amounts of water as soon as it is created.
- The runoff of sediments, which includes soil and plant material, that collects behind the dam represents huge amounts of carbon. In the past, engineers thought dams were useful for capturing and storing carbon. Recent research has shown that when drought causes reservoirs to lose water, a significant portion of that carbon is exposed and decomposes, thus increasing the amount of carbon in the atmosphere and thus increasing climate change. And reservoirs that are used to irrigate crops are bringing much more of that carbon back onto the land to decompose.
- Earthquakes, volcanoes, and heavy rains can cause a dam to break. Human engineering has supposedly ensured that recently built dams in the US cannot be damaged by an earthquake. But most of our dams were built decades ago, before engineering advances could ensure safer dams.
- According to the Northwest Power and Conservation Council, “a dam presents an obstacle to migrating fish. Dams block the downstream movement of juvenile fish to the waters where they will spend their adult lives — the ocean for salmon and steelhead, or a lake or river for resident fish like trout, bull trout, or sturgeon. With more than 400 dams in the Columbia River Basin, and more than half of them dedicated fully or partly to generating hydropower, the region’s primary source of electricity, fish passage at dams has been a major problem for nearly as long as dams have been built in the basin.”

More than 50% of dams in the USA are privately owned, which can result in inadequate maintenance. Of the publicly owned dams, about 4.8% are maintained by States, and 4.7% are Federally-owned. Many of these Federal dams are maintained and operated by the Army Corps of Engineers and the Bureau of Reclamation.

Approximately 15,600 dams in the USA are classified as high-hazard structures, meaning that if the dam fails, it will likely cause loss of life, and over 11,000 dams would cause significant economic damage if the dam fails.

And numerous dams have failed. In 1976, the Teton Dam in Eastern Idaho broke as the reservoir behind it was being filled for the first time. Eleven people were killed. In February 2017, after heavy rainfall, the Oroville earthfill embankment dam in California threatened to fail, and hundreds of thousands of people had to evacuate the area below the dam, before the dam could be repaired. Two earthen embankment dams in Michigan failed in May 2020. The Edenville Dam breached during spring rains, causing the Sanford dam downstream to fail, resulting in severe flooding.

In the US news these past few weeks there have been several reports of heavy rainfall which has caused massive amounts of flooding. These changes in weather, the direct result of global climate change, caused by humanity's failures in long-range planning, is now affecting and is affected by dams.

In 1938, the earthfill Fort Peck Dam breached as it was nearing completion of construction, killing eight men and injuring 34. A friend of mine told me that her grandparents lost their farms when the Fort Peck Dam was built on the Missouri River in northern Montana. Their farms had been in the rich soil created by the river floodplains. They were underpaid for their lost farms, and their new farms, much farther from the river, were in poorer dryland soil. *Northfork* is an excellent but dark fictional movie about families displaced by the building of a dam. It was filmed around the Fort Peck Dam.

Now that global climate change is exacerbating the droughts in the West, many reservoirs are becoming so low that there is concern that they will no longer be able to generate electricity.

Glen Canyon Dam, built on the overused and rapidly declining Colorado River, created Lake Powell Reservoir, which provides hydroelectric power and critical water to farms and ranches and communities. A recent news report stated that the Lake Powell Reservoir is now so low, that the Bureau of Reclamation is concerned that it will soon not be able to produce electricity. Lake Powell provides water through the Hoover Dam to the Lake Mead Reservoir. The Lake Mead Reservoir is also at concerningly low levels. The Colorado River flows through seven Western States, and has a total of 14 dams on the main section of the river, nine of which are used to produce electricity. Several of these dams are now more than 100 years old. The tributaries of the Colorado River include many smaller dams. All the dams on the Colorado River combined provide electricity to about 34 million people. The river has already lost 20% of its size in the past 100 years. The Bureau has to play a delicate balancing act to provide enough releases from each reservoir to maintain the needed water levels in each reservoir.

Dams in the US now are much better regulated than previously, to reduce the likelihood of failure. In developing nations, such regulations are often lacking. In China, during the dictatorship of Chairman Mao from 1958-1976, the Chinese built 84,000 dams. Most were

destroyed in large floods in the 1970s. I saw numerous dams when I traveled through northwestern China by train in 2007. All the reservoirs were significantly silted in, as a result of massive run-off from the surrounding hills and farms, causing devastating loss of soil. This run-off was caused by massive deforestation, done to create many acres of farmland in rural areas, and major growth in the population in these rural areas.

One-third of the 10 million rural Chinese who were displaced to make way for these dams live in abject poverty, and one-third more live at mere subsistence levels. The Three Gorges Dam along the Yangtze River, which took two decades to build and was completed a decade ago, displaced over one million people. The dams effectiveness at preventing floods has been challenged. In 2020, increases in rainfall along the river caused massive flooding, leaving more than 100 people dead and causing over \$20 billion in economic losses.

It is ironic that humans, who have for decades killed beavers because of the dams that beavers build, are doing far more damage than beavers ever could, with our human-created dams. By the way, the dam-building work of beavers is critical to natural habitats throughout the West. But the large dams and reservoirs created by humans destroy natural habitats and displace rural communities. In the words of William Shakespeare's Hamlet, we have been "hoist with our own petard."