THESIS

# ACCELERATING WATERS:

# AN ANTHROPOCENE HISTORY OF COLORADO'S 1976 BIG THOMPSON FLOOD

Submitted by

Will Wright

Department of History

In partial fulfillment of the requirements

For the Degree of Master of Arts

Colorado State University

Fort Collins, Colorado

Summer 2016

Master's committee:

Advisor: Mark Fiege

Jared Orsi
Adrian Howkins
Jill Baron

ABSTRACT

ACCELERATING WATERS:

AN ANTHROPOCENE HISTORY OF COLORADO'S 1976 BIG THOMPSON FLOOD

Scale matters. But in the Anthropocene, it is not clear how environmental scholars navigate between analytical levels from local and regional phenomena on the one hand, to global Earth-system processes on the other. The Anthropocene, in particular, challenges the ways in which history has traditionally been conceived and narrated, as this new geological epoch suggests that humans now rival the great forces of nature. The Big Thompson River Flood of 1976 provides an opportunity to explore these issues. Over the Anthropocene's "Great Acceleration" spike, human activities and environmental change intensified both in Colorado's Big Thompson Canyon and across much of the world. The same forces that amplified human vulnerability to the catastrophic deluge on a micro-level through highway construction, automobile vacationing, and suburban development were also at work with the planetary upsurge in roads, cars, tourism, atmospheric carbon dioxide, and flooding on the macro-level. As a theoretical tool, the Anthropocene offers a more ecological means to think and write about relationships among time and space.

PREFACE

The idea for this thesis started with several disasters and a cartoon—though not together. When I was first admitted to Colorado State University, it seemed like environmental catastrophes were all around me. In Helena, Montana, where I had previously called home, the year 2011 brought flooding to the Ten Mile and Prickly Pear Creeks. I found myself stacking sandbags for community defense, but houses still got swamped. One poor soul extracted some humor from the inundation, erecting a makeshift sign that read: "House for sale, newly-installed indoor pool." During roughly the same time, entire tracts of the surrounding coniferous forest turned from evergreen to rust-orange as mountain pine beetle outbreaks reached epidemic (not endemic) proportions. In Fort Collins, Colorado, where I was soon to live, the 2012 High Park Fire consumed thousands of acres. To the south in Colorado Springs, not even a month later, the Waldo Canyon Fire threatened ex-urban residences. Finally, a week-long rain event struck the Front Range of northern Colorado in 2013. I remember traveling through the Big Thompson Canyon when I first arrived at CSU and seeing a washing-machine dangling out from the gaping floor of a cabin that had its foundation eroded away. All these extreme events seemed to be connected somehow, someway. I wanted to know more.

In summer 2014, my thoughts about these disasters more or less came together during the WEST Network Conference in the Tobacco Root Mountains of Montana. At one of the sessions, historian Tim LeCain had utilized dry-erase markers and a whiteboard to sketch a cartoon for his presentation. While the drawings were meant to be comical (one panel contained a Superman hero crest, while another included a caricatured earth with devilish features), the ensuing debate was not. The topic for this scholarly exchange was the intellectual validity of the Anthropocene, a new geologic epoch popularly referred to as the "Age of Humans." The concept posited that many, if not most, of the Earth's systems had become driven by human activities over the modern era. Some defended it. Others disparaged it. Still others didn't know what to think about it. But from the most junior of junior scholars like myself at the time to most senior of senior scholars, all participants were engrossed by the subject. After an intense debate, my graduate advisor Mark Fiege walked up to me and said something along the lines of: "This is the type of conversation you want your thesis to speak to." From then on, I knew that my thesis would explore the intersections of disaster and the Anthropocene.

ACKNOWLEDGEMENTS

Like any ecological relationship, this project connected me to numerous people and institutions. Mark Fiege has opened my eyes to seeing the world in a totally different way. Good conversation, bottomless coffee, and yet another book recommendation were always at the ready. I owe deep gratitude to Mark for my intellectual development and for any (good) ideas that spill over these pages. I also must thank him for getting me interested in environmental history in the first place: the irrigated fields of Idaho's Snake River Plain were both the subject of his first book and the substance of my childhood home. Jared Orsi has been a phenomenal writing coach, a great mentor, and a constant reminder on the cosmic significance of "three." Adrian Howkins has always pushed me to expand my horizons by relentlessly asking me how history looks different from a trans-national perspective. Jill Baron has provided an excellent model of someone who has reached across the divides of academia. I thank her and Ruth Alexander for allowing me to be a participant in the Global Challenge Research Team, an interdisciplinary group of ecologists, environmental historians, and public-lands managers during my first year at CSU. Day after day, I thought about the special bond between history and science. No doubt this thesis challenged me to read a good deal in geology, hydrology, and climatology.

In addition to those mentioned above, I thank Janet Ore, Sarah Payne, Robert Gudmestad, Elizabeth Jones, Maren Bzdek, Dane Vanhoozer, Mark Boxell, Katelyn Weber, Sean Fallon, Maggie Moss Jones, Poppie Gullett, among countless others, for shaping the direction of my project with our conversations. All of them make Colorado State University one of the best places for environmental history. Generous financial support from CSU's History Department and College of Liberal Arts, the American Society for Environmental History and National Science Foundation, and Brigham Young University's Charles Redd Center for Western Studies afforded me opportunities for research and conference travel. I also relied on many people to navigate various repositories and I am grateful for their kind assistance: Patty Rettig and Clarrisa Trapp at CSU's Water Resources Archive; Kelly Cahill at the Rocky Mountain National Park Archives; Naomi Gerakios Mucci at the Fort Collins Museum of Discovery and Estes Park Museum; Sharlynn Wamsley with the Big Thompson Canyon Association; Marene Baker at the National Archives and Records Administration, Rocky Mountain Region; Lisa Schoch at the Colorado Department of Transportation; Greg Silkensen at the Northern Colorado Water Conservancy District; and the archivists and staff at the Colorado State Archives, Denver Public Library, and History Colorado. I thank Chrissy Esposito and Sophia Lynn at CSU's Geospatial Centroid for creating the maps to complement this project. I am particularly indebted to the historical collections of Kenneth Wright (no relation) and David McComb, as they make up the backbone of this work.

A community of friends and family sustained me through the intimidating challenges of graduate school and thesis writing. I thank Mike Fitch and Bob Swartout for first cultivating my sense of wonder and fascination with the past. I also wish to thank Ashten and Dane Broadhead for pulling Carly and me away from Colorado enough to keep our loving connection with Montana. I am indebted to Ryan, Adam, Clint, Rachel, Lexie, Leah, Cleve, Tohlina, Braxton, and Cara for supporting us in one way or another. I am very grateful for my parents, Russ and Andrea Wright, for their unceasing love and our "long" hikes in Rocky Mountain National Park. I am also thankful for an "extra" set of parents, Robie and Brad Culver, with their unfailing support and not-so-subtle prompts that adventures are preferable to work every once in a while. Finally, my deepest gratitude goes to my wife, Carly Culver Wright. She has known when and how to guide me back to the things that matter most. Carly has been my companion through the

thick-and-thin of life: always sharing, always devoting, and always loving. It is to her that I dedicate this work.

DEDICATION

*For Carly*

TABLE OF CONTENTS

LIST OF FIGURES

# INTRODUCTION

## THE CHALLENGE OF THE ANTHROPOCENE

On September 9, 2013, dark, billowing clouds gathered over the Front Range of northern Colorado. A humid, monsoonal front met the eastern slopes of the Rocky Mountains, producing a large storm cell over the parched landscape. It began to rain. The downpour intensified and kept up over the next six days—16.9 inches of rain in Boulder, 9.3 in Estes Park, 5.9 in Loveland, and 6 in Fort Collins. Most streams of the South Platte River Basin swelled in their channels, overtopped their banks, and inundated the surrounding areas. Across seventeen counties, the floods eradicated roadways, demolished bridges, damaged some 26,000 dwellings, razed over 2,000 homes, and caused an estimated two billion dollars in property losses. Eight people lost their lives, with thousands more endangered and dispossessed.[1]

After the deluges subsided on September 15, some people turned their attention to larger scales. Many scientists, for example, began discussing the possible relationship between the floods and climate change. State climatologist Nolan Doesken remarked, "…as a best guide, assume the risk will be higher in the future because a warmer atmosphere will have potential to carry and deliver more water vapor to whatever storm systems we happen to have."[2] Matt Kelsch, a hydrometeorologist with the National Center for Atmospheric Research in Boulder, offered a similar assessment: "We may be getting longer dry spells but then when it does rain or snow, it's more intense."[3] For these specialists, the northern Colorado floods were simultaneously local and global phenomena.[4]

Like Doesken and Kelsch, scientists today are trying to explain localized environmental circumstances within broader global-change systems. One catalyst for this trend came in late

February 2000 at the International Geosphere-Biosphere Programme Conference in Cuernavaca, Mexico. At the annual forum, scientists from around the world gathered to discuss the impacts of Earth-system changes. During one of the meetings, a linguistic bombshell was dropped. Dutch atmospheric chemist and Nobel-laureate Paul Crutzen, in response to remarks about the current Holocene epoch, proclaimed: "No, we are in the *Anthropocene*."[5] Members in the assembly were shocked by Crutzen's statement as it suggested that the human species, collectively, has become a global geophysical force. This term for a new geologic epoch appeared again that same year, authored for the first time in print by Crutzen and American biologist Eugene F. Stoermer. Since that date, the "Anthropocene" label has been confronting scientists, historians, and other scholars.[6]

Following Crutzen's declaration, the Anthropocene—which tends to underscore global changes over local ones, humanity over individuals—presents challenges for historical inquiry in regard to scale.[7] Many environmental historians, unlike Doesken and Kelsch, have typically focused on examining topics within micro-scales of analysis. For example, William Cronon advised the discipline in 1990 to explore the interactions between human and nonhuman nature "at the local and regional level" in order to refine the field's investigative tools.[8] Over the last thirty or so years, scholarly works within this tradition of environmental history have tended to embrace smaller scales.[9] A tension thus surfaces, both conceptually and narratively, between micro-level approaches and a macro-oriented geologic epoch.[10] How can environmental historians produce micro-histories within the theoretical approach of the Anthropocene? Or put another way, how can scholars reconcile people and place when they write about the human species and the planetary whole?[11]

A solid place to explore questions of geologic significance can be found by returning to the Front Range of the Rockies, the South Platte River Basin, and the canyons that experience recurrent flooding. The Big Thompson River Flood of 1976, in particular, one of the ten most lethal deluges in the twentieth-century United States and the deadliest in Colorado's history, reveals the dynamic interplay of varying scales.[12] For a combination of anthropogenic and environmental forces emblematic of the Anthropocene shaped the Big Thompson Canyon; and these factors, in turn, intensified human vulnerability leading up to the devastating 1976 flood.[13] By connecting human history to Earth history, this story examines local phenomena within a global framework in order to expose the relationships among differing temporal and spatial levels.[14] The Anthropocene not only helps us comprehend how larger economic, social, and environmental trends have affected the Big Thompson Canyon, but events within the mountain gorge provide a better understanding of the cultural logic behind the Anthropocene.[15]

### *The Anthropocene*

The Association for Environmental Studies and Sciences chose "Welcome to the Anthropocene" as the 2014 theme for its annual conference in New York City.[16] Andrew Revkin, a *New York Times* columnist and senior fellow at Pace University, gave the keynote address on planetary stewardship in the Anthropocene. During his presentation, Revkin stated, "You can look at it and go 'Oh my God,' or you can look at it and go 'Wow, what an amazing time to be alive!' I kind of choose the latter."[17] A few days after the talk, Clive Hamilton, an ethicist at Charles Sturt University in Australia, criticized Revkin for overly-wishful thinking regarding a "Good" Anthropocene. Hamilton, above all, lambasted the speech for overlooking the uneven distribution of global changes on human populations.[18] The Revkin-Hamilton quarrel epitomizes the contentious reality of this new geologic epoch. This work suggests that the Anthropocene, despite these debates and critiques, offers a useful analytical tool for historical narratives.

There are multiple definitions of the Anthropocene; and each arise from diverse fields of inquiry. Geoscientists characterize this new epoch in the strictest sense from evidence in rock layers. In the geologic past, the Anthropocene represents an identifiable "golden spike" for human activities. Alternatively, climatologists, ecologists, and those who fit under the wide umbrella of Earth-system sciences reason that the planet has left the normative boundaries of global energy and material cycles. For these scholars, the human-driven carbon and water cycles—which this flood story engages most often—among other global systems, signals the arrival of the Anthropocene.[19] Referred as the "Age of Humans" in newspaper articles, popular magazines, and other general accounts, the most widespread definition of the Anthropocene entails recognizing a fundamental shift in human-environmental interactions. In this broadest understanding, our modern civilization has become a force of nature.[20]

A substantial debate concerns the beginning date for the Anthropocene. Climate scientist Will Steffen, along with other scholars, delivered an initial framework for thinking about "this quantitative shift in the relationship between humans and the global environment."[21] Anchored in geologic "deep time," the group proposes that the breaking point from the Holocene began around 1800 A.D. with humans' exploitation of fossil fuels during the Industrial Revolution. This initial phase of the Anthropocene marks a transition from an ancient-organic energy system—based on solar, wind, water, and muscle power—to a hydrocarbon energy regime—derived from burning coal and petroleum for mechanical power. From an Earth-systems approach, the thermo-industrial revolution moved carbon from the ground and into the air, pushing atmospheric $CO_2$ conditions outside Holocene variability between 260 and 280 parts per million.[22]

These researchers also suggest that our planet entered a second phase, called the "Great Acceleration," when human activities underwent a dramatic upsurge around 1945 A.D. During this period, scientific and technological breakthroughs merged with free market-oriented institutions to facilitate this exponential outburst. The principal markers of the Great Acceleration, according to this interpretation, are population growth, economic expansion, and trade intensification. But these are not the only indicators: socio-economic factors like the upsurge in paper consumption and McDonald's restaurants grew alongside environmental factors such as deforestation and nonhuman species extinctions. This narrative will use the "Great Acceleration" as a conceptual tool for joining micro- and macro-levels of analysis, linking this local disaster within the Big Thompson Canyon to the worldwide upsurge of roads, cars, tourism, atmospheric carbon dioxide, and flooding. In sum, the Anthropocene demarcates when humans became a major driver of the Earth's biological, geological, and chemical systems. The Great Acceleration delineates a rapid intensification of both human enterprises and global environmental change.[23]

Other scholars have disputed this claim, arguing for earlier or later chronologies. Paleoclimatologist William Ruddiman, for example, put forward an "early Anthropocene" hypothesis. Ruddiman contends that the new epoch began approximately 8,000 years ago with the Neolithic Revolution, or the rise of intensive agriculture and deforestation. These practices, according to this argument, account for the gradual increase of anthropogenic greenhouse gases, and ultimately, human-induced climate change.[24] Stratigrapher Jan Zalasiewicz and colleagues, most recently, support the post-World War II "Great Acceleration" spike as the onset of the Anthropocene. They assert that nuclear radiation leftover from atomic explosions and plastic waste after consumptive uses—the so-called "Coca-Cola layer"—would provide a reasonable geologic boundary.[25] While governing bodies like International Commission on Stratigraphy have not formalized an official start date (to be decided in 2016 or 2017), the Anthropocene has already gained significant academic traction. For many environmental scholars, this new epoch is here to stay.[26]

Some intellectuals have criticized various facets of the Anthropocene term itself. For instance, cultural anthropologist Alf Hornborg claims that a different name, the “Technocene,” better acknowledges the part that industrial machinery played in altering the face of the planet.[27] From a materialist stance, in contrast, environmental historian Tim LeCain suggests that the Anthropocene is far too anthropocentric and reinforces a nature-culture divide. LeCain argues that a more reasonable term might be “Carbocene,” recognizing the powerful role of fossil fuels.[28] Human ecologist Andreas Malm, from a Marxist perspective, points out how uneven class differences have been overshadowed by an undifferentiated humanity. Malm asserts that a more fitting label could be “Capitalocene,” assigning blame for planetary distress to neoliberal capitalism.[29] Other academics have used “Plutocrocene” to a similar effect.[30] These scholars have underscored that the Anthropocene, or when humans reached the status of a telluric force, was contingent upon certain technological, material, and economic forces. More specifically, they have illuminated the fact that this new geologic epoch is inherently historical.

In spite of these debates and critiques, the Anthropocene concept provides a useful methodological tool for environmental scholars in general and this thesis in particular.[31] Because the Anthropocene and deep history are inseparable, a geological framework helps narratives to function on multiple temporal scales over very long time frames.[32] This account of the Big Thompson Flood slides over time spans from the Pleistocene ice of 1,000,000 B.C. to the verge of the Great Acceleration in 1933. In addition, the global structure of the Anthropocene assists environmental histories in shifting among various spatial levels. This flood story moves from the micro-scale of the Big Thompson Canyon in northern Colorado, to the macro-scale of the Earth, and back again. This thesis, in part, engages the overall task of weaving more theory—the Great Acceleration of the Anthropocene in this particular case—into historical narratives.[33] With the goal of making the Anthropocene epoch more analytically distinct and thus critically useful, we delve into the deep history of the Big Thompson Canyon.

### *Big Thompson Canyon in Deep Time*

Every autumn from roughly 3,500 to 800 B.C., Archaic peoples were likely on the move down from the Rocky Mountains towards the Front Range. These Paleo-Indians had filled their bellies with meat from elk, deer, and mountain sheep that they funneled through stone-constructed walls, ambushed with spears and rocks, and killed for winter sustenance. After fall hunts, they sought milder weather during the snowier months typically found on the basin-shaped landscape at the foot of the Rockies. As part of this trek, large groups presumably passed through the Big Thompson Canyon and other gorge routes to reach their seasonal destinations. They lived a perilous existence at times: caught too late in these mountain canyons or amidst an early storm, these individuals probably perished.[34] Before the Anthropocene, humans encountered material forces on varying scales that frequently overpowered them. The recent work of archaeologists, geologists, and other scientists helps to tell this story.[35]

Whether known to Archaic persons or not, the foothills they sought and the mountains they fled began to take shape some eighty million years ago. During the Late Cretaceous epoch, the nascent North American continent underwent cataclysmic geological changes. Two tectonic plates smashed together with immense force. The oceanic, northeast-sliding Farallon plate collided with the westerly North American plate like two cars crashing into each other on a high-speed freeway. Something had to give. In this case, the former plate slid underneath the latter in a process that geologists have called subduction. Instead of traveling at the abrupt downward slant common for these types of collisions, the Farallon plate drove into the mantle at a flat angle. This tectonic force piled up sheets of crust into peaks and ridges in the foreland region of the American Cordillera, a far more interior location than usual. This millennia-long series of mountain building events, known as the Laramide Orogeny, produced the Rocky Mountains.[36]

The Rockies, despite these massive early changes, continued to encounter dramatic physical transformations. Scientists have discovered that the Farallon plate eventually plunged downward en route to the molten core roughly forty-three to twenty-one million years ago, thrusting waves of magma towards the crust. This fiery substance spewed over the future Great Basin through massive calderas. These volcanic craters subsided approximately fifteen million years back, but a pocket of blistering mantle welled up underneath the planet's surface and remained for nearly ten million years. The hot, buoyant force pushed the Rocky Mountains further upward, causing them to rise taller and taller, a process that still continues today. Around the same time period, climatic shifts produced giant floods on the growing slopes that scoured the neighboring Great Plains of its Miocene gravel. This exhumation revealed the mountains in more dramatic fashion. The mass excavation also shaped a bowl-like piedmont and provided a future winter refuge for Archaic peoples—the Front Range.[37]

Like most early humans, Native Americans realized the commanding material world that surrounded them. The Arapahoes, or *Inuna-ina*, relocated from the Black Hills of the Dakotas to the Platte River Basin of Colorado and Wyoming by the end of the eighteenth century. They had established a new territorial domain with their Cheyenne allies to take advantage of burgeoning trade networks among Anglo Americans, Europeans, and Indians. Although these two Native societies mostly hunted bison on horseback within the central Plains, small bands of Arapahoes sometimes confronted the geological powers of the Rocky Mountains in order to harness their spiritual powers. Occasionally, Arapahoes took multiple-day excursions up the narrow canyon of the Big Thompson River, called *hāātjâ-nōōńt-nēēcheé*, “the Pipe River,” or literally translated “where pipes were made.” Ethnographers have documented how they crafted stone smoking pipes alongside the mountain stream and invoked Sacred Pipe, the Creator. Upon reaching Estes Park, or *tah-kâh-āānoń*, “the Circle,” Arapaho men underwent vision quests upon a conical hill of granite called *hinánatoXthāuXūt*, “Sitting Man,” or known today as Old Man Mountain. As individuals trudged toward the rocky crown, they quenched their thirst in weathered drinking pools. At the culmination of the exhausting journey, these indigenous peoples fasted, smoked, and called on the divine.[38]

Figure 0.1. A Native American tipi and fire ring alongside the Big Thompson River. Courtesy of Rocky Mountain National Park Archives.

When Arapahoes crested Sitting Man, the moraine vista and mountain river that they witnessed below came from the earlier dominance of ice and water. When the Rocky Mountains arose from the planet's crust millennia before, erosion immediately began tearing them down. Nearly two million years ago, large glaciers carved into the mountainsides like fingers running through putty. Pleistocene glaciation, characterized by scientists as series of advancing and receding ice sheets, promoted additional creases and wrinkles on this elevated landscape. It scraped U-shaped valleys like Estes Park out of various rock formations. When the Ice Age ended about eleven thousand years ago, most of the permanent snow melted, creating streams as water sliced into the landscape. The river discharge carried debris from high ranges to lowland plains, depositing sediments over time in an alluvial fan that formed the adjoining foothills. The South Platte River Basin became recognizable as it eroded the Rockies to form its various tributaries—Clear Creek, Cache la Poudre River, Saint Vrain River, and Big Thompson River.[39]

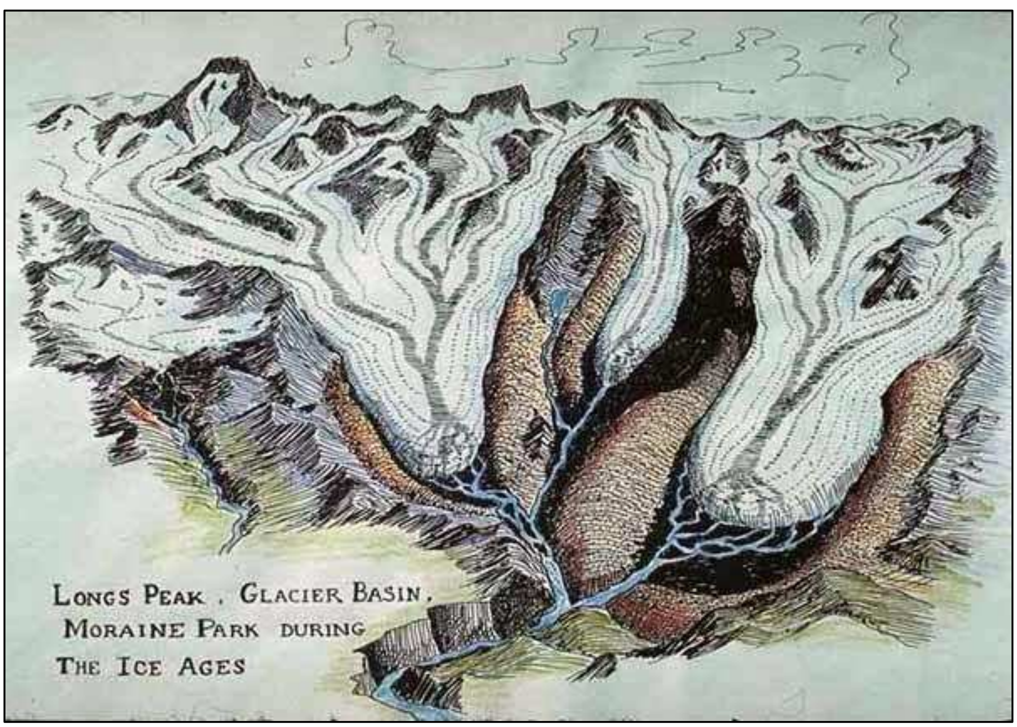



Figure 0.2. An artistic depiction of glaciers during the Pleistocene "Ice Age," carving out moraine valleys into the Rocky Mountains. Note the formation of the Big Thompson River near the bottom. Courtesy of Rocky Mountain National Park Archives.

The headwaters of the Big Thompson River developed from the glaciers near Forest Canyon in what is now Rocky Mountain National Park. The snow-melt waters meandered eastward through the high wetland meadows of Moraine Park to the site of the future Euro-American resort community of Estes Park. The north fork of the Big Thompson also commenced within this forthcoming national park site at the slopes of the Mummy Range, named *nah ou-bāāthā*, "White Owls," by the Arapahoes. The river flowed through a more northerly valley until it met up with the main stem near the future hamlet of Drake in the Big Thompson Canyon. From Estes Park, the river descended one-half mile in elevation through mountains occupied by coniferous bands of pine and fir trees into a 25-mile-long canyon. In time, the river would pass by the future locations of tourist settlements—Cedar Cove, Drake, Waltonia, Glen Comfort, Glen Haven, and Loveland Heights. Within the gorge, numerous rivulets poured out of their respective gulches and added water to the primary stream. The river emerged out of two constricting granite walls, called the Narrows, as it traveled by red shale hogback ridges at the foothills. The stream flowed south of the future Euro-American town site of Loveland across the plains near what would become the agricultural settlement of Greeley. The watercourse emptied into the South Platte River, which then delivered the water to the Missouri-Mississippi Rivers.[40]

When white newcomers colonized the Front Range during Pike's Peak Gold Rush of the mid-nineteenth century, they often subjected themselves to the capricious nature of the South Platte River tributaries. In June 1864, teenage-boy Abner Sprague moved with his parents and siblings from Illinois to a squatter's claim near the Big Thompson River, a few miles east of the canyon. Only a month before their arrival, the stream had flooded and wiped out the numerous homesteads that dotted the valley. The torrent, however, did not deter many Euro-Americans like the Spragues from growing crops for the burgeoning mining population around Denver. Four years after establishing a family farm, Sprague and two schoolmates decided to take their "Indian ponies" and explore the upper reaches of the river encased within the Big Thompson Canyon. Lofty expectations quickly turned into humbling reality. The trio, in Sprague's later memories, soon realized that "the walls of the canyon were too steep and rugged to follow the stream" and that "the water in the creek was too high and the boulders too large for a crossing." Nearly a week's time passed on the "poor horse trail" before Sprague and friends actually reached Estes Park.[41]

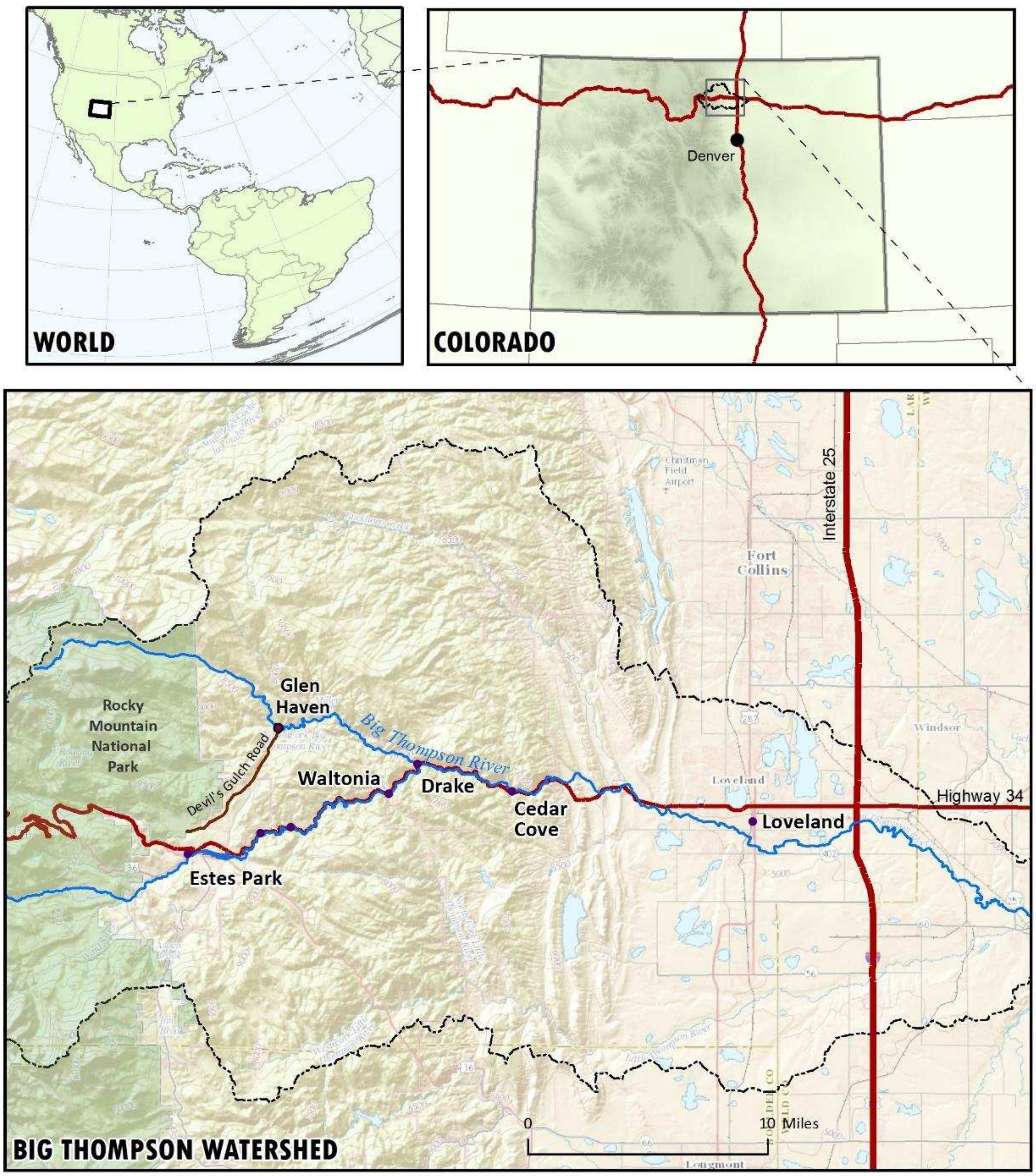
The Big Thompson River, which tormented Sprague's trip and wiped agricultural prospects away, was—and still is—inextricably linked to the global water cycle. The voyage begins over the ocean where solar radiation evaporates water into the atmosphere. From there, tropical winds move the warm, moist air over the North American continent. The Front Range of Colorado is in a somewhat unique location, according to hydrologists, in that moisture-laden air masses originate from two locations: both the Pacific Ocean and the Gulf of Mexico. Bands of weather, or cells, form as these parcels of air lose their water-holding capacity. Clouds release their water as precipitation usually through three different types of air uplift. In a frontal system, a warm equatorial air mass meets a cold polar front, which causes the tropical moisture to rise, condense, and then drop as rain in a fairly uniform manner. In a convective storm, a warm ground surface drives an air mass upward, developing powerful updrafts and downdrafts that occur in cyclical loops. The water collects as it spirals, producing thunderhead clouds and sporadic rainfall. The last mode of precipitation, which scientists have called orographic lift, occurs when wind pushes warm air over mountains. As an air pocket rises in elevation, cooler temperatures force the weather cell to release its moisture as rain, sleet, or snow. In all these instances, water falls toward the Earth, some of which feeds the Big Thompson River, and on occasion, produces a flood.[42]

In most cases, storm clouds deposit water on higher elevations, such as the crests of the Rocky Mountains. Whether as melted snow or rain, scientists have noted that water disperses to various places. A large portion of the water infiltrates into the terrain, percolating down into the soil as it saturates to the groundwater table. Some of the liquid evaporates back into the atmosphere. Vegetation intercepts its share of water, which is transpired through plants into the air. A small slice of the water actually flows over the land surface. It amasses in ravines and canyons shaped by earlier geomorphic processes; these fluvial energies crafted the chiseled granites, schists, and gneisses that Sprague found "too steep and rugged." As water gathers, the stream forms and tries to follow the path of least resistance. The river tumbles along fault and fold lines, molding and establishing its route. A river channel, though, is naturally dynamic: changing its course, size, and shape over time as the topography allows.[43]

Flooding was both an integral and natural component for the Big Thompson River as it roamed on its path from sky to sea. This process occurred when the stream overtopped its banks and gushed onto surrounding lands called the floodplain, or intense rainfall led to concentrated overland flow that engulfed an area. Frequent inundations, generally speaking, support living creatures. They deposit nutrient-rich alluvium onto nearby riparian spaces, typically creating fertile soil that the Spragues and other farmers had come to rely upon. Moreover, recurrent floods serve numerous ecological functions as spillovers created differentiated habitats for both aquatic and terrestrial species. Between the 1864 and 1976 Big Thompson Floods, historical records have registered twelve large deluges in the canyon—1894, 1906, 1919, 1938, and 1951 to name a few—and many other smaller floods. These torrents became more hazardous to people—like Sprague's neighbors and the numerous individuals in decades to come—when they, along with their structures and dwellings, permanently occupied the low-lying floodplain.[44]

From the Pleistocene to the Holocene, material elements on various scales had generally overwhelmed humans. Recent scientific understandings have validated that planetary processes in geologic time—from tectonic plates to the global water cycle—forced Archaic, Arapaho, and Anglo peoples to live within the natural realities of a canyon river environment. The geophysical features of the Rocky Mountains not only provided structural control over the direction of the Big Thompson River, but they also exerted power over the range of human potentialities. The canyon directed where people and water could go, as well as how they could reasonably move, for thousands of years. While material forces of the deep past may only be dimly visible, these geological and fluvial energies are no less significant in circumscribing human history.[45]

Enter the Anthropocene. The scale, scope, and degree of anthropogenic impacts upon the global environment were growing over the nineteenth century. And by the mid-twentieth century, they would become unprecedented.[46] Humans temporarily weakened their biophysical restraints with the adoption of fossil fuel-based technologies, and wrought ecological changes—such as ocean acidification and mass extinctions—across the planet.[47] Coloradans' relationship with the Big Thompson Canyon fundamentally changed as well. Over the Great Acceleration, people utilized powerful hydrocarbon energy to chisel out a major roadway within the gorge, speed through the mountain access, and engulf the riverfront with vacation houses. Our species, moreover, started to drive many material systems around the world—from the carbon cycle related to a warming globe, to the nitrogen cycle linked to industrial-style agriculture. The Big Thompson River was no different: human-built infrastructure altered the hydrological and carbon cycles in a myriad of ways, making the 1976 deluge far from a “natural disaster.” During the Anthropocene, people were no longer small actors in a big world. Instead, with the embrace of fossil fuels, they became big—even geophysical—agents in a shrinking world.




Credit: Geospatial Centroid (2016)
Base Map, USGS National Map

Figure 0.3. Map of Big Thompson River watershed in relation to Colorado and world. Map by Chrissy Esposito and Sophia Linn, Geospatial Centroid, Colorado State University.

On the verge of the Great Acceleration in the 1930s, humans were akin to a geomorphic force when they erected a modern highway within the Big Thompson Canyon. While New Deal programs delivered the capital and workers necessary for massive public works schemes within the United States, two global components developed over the first phase of the Anthropocene that actually made construction possible. First, a merger of energy systems between laborers' organic bodies and hydrocarbon-burning machines allowed an immense amount of rubble to be moved. Second, the build-up of engineering knowledge and scientific expertise gave Charles Vail and the Colorado State Highway Department unquestioned technical authority over the road-building project. Construction crews ultimately built U.S. Highway 34 between the canyon walls, facilitating a boom in automobile tourism upon completion. These engineers, however, paid more attention to the modern road and less consideration to the mountain river. Both led to intended and inadvertent hydrological impacts.

Over the post-World War II years, tourism organizations capitalized on the Great Acceleration of roads, cars, and fossil fuels. The Estes Park Chamber of Commerce and other boosters promoted idealized versions of the Big Thompson Canyon, highlighting natural wonders and downplaying natural hazards, in order to entice visitors. These vacation entities, in part, fed into popular ideas of "mass consumption" representative of the Anthropocene. Through consumer-driven messages, they encouraged more and more people to embark on vacations to Estes Park and Rocky Mountain National Park. Summer cabins, motels, and tourist shops sprang up along waterfront of the Big Thompson River to accommodate these expanding leisure practices. In place of riparian areas that once flexibly adjusted to water overflow, human encroachment transformed the floodplain into standardized parcels of vinyl siding, concrete pavement, and verdant crabgrass. Aside from riverfront modifications, an increasing riverine population also meant an increasing vulnerability to a devastating flood.

In the summer of 1976, social, technological, and environmental factors consistent with the Anthropocene intermingled to produce a hybrid torrent—the Big Thompson Flood. Human actions and decisions over the Great Acceleration amplified the material power of the deluge. Highway infrastructure, automobile travel, and recreational habits combined with twelve inches of downpour; the repercussions for canyon properties and inhabitants were destruction and death. In the aftermath of the deluge, the "momentum" from the Great Acceleration prevented serious consideration of alternative paths for disaster recovery. The intellectual underpinnings of the era were so geared towards supporting features of the Anthropocene's second phase that most people could not imagine different courses of action. And for the few who could, their ideas mostly fell on deaf ears. As a result, the canyon was restored to similar, pre-flood conditions which would have direct consequences in the decades to come.

* * *

During the 2013 northern Colorado floods, the Big Thompson River once again rumbled through its canyon walls, just as it had thirty-seven years prior. Much like before, the floodwaters tore up seventeen miles of the rebuilt U.S. Highway 34 within the gorge.[48] As road engineers grappled with what to do with the tourist expressway, some began to think more ecologically about the challenges to human resiliency. Johnny Olson, regional director of the Colorado Department of Transportation, declared that in order to avoid repeated damages to human-built infrastructure, "We have to look at the river and the roadway as a system."[49] These local musings paralleled larger trends going on within the global scene. Climate scientist Will Steffen and other scholars argue that we have now transitioned away from the Great Acceleration into a third phase of the Anthropocene. This period is punctuated by an increasing awareness of human-induced stressors to our Earth systems and by wrestling with how to move towards viable planetary management.[50]

The Anthropocene is different from the Holocene or the Pleistocene or other geologic epochs. It is not merely another period of Earth history in the deep past. Rather, it poses all sorts of theoretical and narrative challenges to the way that environmental historians usually think and write about that past. But then again, it also invites all historians to do history differently.[51]

NOTES

[1] Ruth M. Alexander, "Final Report: 2013 Northern Colorado Flood History Project," January 2015, 2013 Northern Colorado Oral History Collection, Water Resources Archive, Colorado State University, Fort Collins, Colorado (hereafter cited as 2013 Floods Collection); Sarah Hines, "Our Relationship with a Dynamic Landscape: Understanding the 2013 Northern Colorado Flood," *Science You Can Use Bulletin*, United States Forest Service, March-April 2014, http://www.fs.fed.us/rm/science-application-integration/docs/science-you-can-use/2014-03.pdf (accessed on 26 March 2015); Terri Cook, "Disaster strikes along Colorado's Front Range," *EARTH Magazine*, January 2014, http://www.earthmagazine.org/article/disaster-strikes-along-colorados-front-range (accessed on 26 March 2015).

[2] Nolan Doesken, interview by Zach Lewis, digital recording, 3 July 2014, 2013 Floods Collection.

[3] Kelsch as quoted in Kiley Kroh, "After the Flood: How Climate Change Changed One Colorado Community Forever," *Climate Progress*, 10 October 2013, http://thinkprogress.org/climate/2013/10/10/2741901/colorado-flood-fire/ (accessed on 26 March 2015).

[4] Although a recent study established that the connection between the 2013 extreme rain event and climate change as inconclusive, people were nonetheless thinking on global scales. For more details, see Martin Hoerling et al., "Northeast Colorado Extreme Rains Interpreted in a Climate Change Context," *Bulletin of the American Meteorlogical Society* 95 (September 2014): 15-18, http://journals.ametsoc.org/doi/pdf/10.1175/ 1520-0477-95.9.S1.1 (accessed on 26 March 2015).

[5] Crutzen as quoted in Fred Pearce, *With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change* (Boston: Beacon Press, 2007), 27. Italics added by author to emphasize the new "Anthropocene" term. For more on the context of Crutzen's remarks, see Paul Crutzen, interview by Christian Schwägerl, 2013, Deutsches Museum, Environment and Society Portal, http://www.environmentandsociety.org/exhibitions/anthropocene/huge-variety-possibilities-interview-nobel-laureate-paul-crutzen-his-life (accessed on 5 January 2016).

[6] Paul Crutzen and Eugene Stoermer, "The Anthropocene," *International Geosphere-Biosphere Programme's Global Change Newsletter* 41 (May 2000): 17-18.

[7] Libby Robin, "Histories for Changing Times: Entering the Anthropocene?" *Australian Historical Studies* 44 (2013): 329-40; Fredrik Albritton Jonsson, "The Industrial Revolution in the Anthropocene," *Journal of Modern History* 84 (2012): 679-96; Alison Bashford, "The Anthropocene is Modern History: Reflections on Climate and Australian Deep Time," *Australian Historical Studies* 44 (2013): 341-49; Libby Robin and Will Steffen, "History of the Anthropocene," *History Compass* 5 (2007): 1694-1719.

[8] William Cronon, "Modes of Prophecy and Production: Placing Nature in History," *Journal of American History* 76 (March 1990): 1130.

[9] For some examples of exceptional works in environmental history that possess local or regional emphases, see William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983); Nancy Langston, *Where Land and Water Meet: A Western Landscape Transformed* (Seattle: University of Washington Press, 2003); Matthew Klingle, *Emerald City: An Environmental History of Seattle* (New Haven, CT: Yale University Press, 2007); Stephen Mosley, *The Chimney of the World: A History of Smoke Pollution in Victorian and Edwardian Manchester* (New York: Routledge, 2008); Marsha Weisiger, *Dreaming of Sheep in Navajo Country* (Seattle: University of Washington Press, 2011); Jerry J. Frank, *Making Rocky Mountain National Park: The Environmental History of an American Treasure* (Lawrence: University Press of Kansas, 2013); Thomas G. Andrews, *Coyote Valley: Deep History in the High Rockies* (Cambridge, MA: Harvard University Press, 2015). For other examples with a more global focus, see J.R. McNeill, *Something New Under the Sun: An Environmental History of the Twentieth-Century World (*New York: W.W. Norton & Company, 2000); Alfred W. Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*, Second Edition (1986; New York: Cambridge University Press, 2004); Gregory T. Cushman, *Guano and the Opening of the Pacific World* (New York: Cambridge University Press, 2013); Bartow J. Elmore, *Citizen Coke: The Making of Coca-Cola Capitalism* (New York: W. W. Norton & Company, 2015).

[10] Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry* 35 (Winter 2009): 201-03, 207-09; Lynn Hunt, *Writing History in the Global Era* (New York: W.W. Norton & Company, 2014), 9-11; Stephen J. Pyne, *Voice and Vision: A Guide to Writing History and Other Serious Nonfiction* (Cambridge, MA: Harvard University Press, 2009), 268-73; John Lewis Gaddis, *The Landscape of History: How Historians Map the Past* (New York: Oxford University Press, 2002), 25-26; 81-84.

[11] The following works were useful in thinking about questions of scale: Lucy R. Lippard, *The Lure of the Local: Senses of Place in a Multicentered Society* (New York: The New Press, 1997); Richard White, "The Nationalization of Nature," *Journal of American History* 86 (December 1999): 976-86 and Ted Steinberg, "Down to Earth: Nature, Agency, and Power in History," *American Historical Review* 107 (June 2002): 798-820. This work hopes to contribute in some small way to the task of connecting local and regional history with global history, which environmental historian Mark Fiege outlines in the article, Mark Fiege, "The Nature of the West and the World," *Western Historical Quarterly* 42 (Autumn 2011): 305-12.

[12] Kayla Webley, "Top Ten Historic U.S. Floods," *TIME Magazine*, 11 May 2011, http://content.time.com/time/specials/packages/article/0,28804,2070796_2070798_2070786,00.html (accessed 14 April 2015).

[13] David McComb, *Big Thompson: Profile of a Natural Disaster* (Boulder, CO: Pruett Publishing Company, 1980). McComb's work is the definitive history on the Big Thompson Flood. McComb views the event as a "natural disaster" devoid of any human influence. He focuses his narrative on the emergency response measures during and after the deluge. My reinterpretation utilizes environmental history to examine the human forces at work on the deluge. For a closer model of what I would like to achieve in this revisionist history, see Jared Orsi, *Hazardous Metropolis: Flooding and Urban Ecology in Los* Angeles (Los Angeles:

University of California Press, 2004) and Ted Steinberg, *Acts of God: An Unnatural History of Natural Disasters* (New York: Oxford University Press, 2000).

[14] Historical geographers have been much more cognizant about issues of scale than environmental historians. In my conception of space, the "local" constitutes the Big Thompson River Canyon while the "global" is the whole Earth. For a work that has influenced my ideas about space and scale, see Andrew Herod, *Scale* (New York: Routledge, 2011), 227-235.

[15] Much discussion in the Anthropocene literature located in the footnotes below does not fully bring out the ideas have motivated human societies to act in certain ways. For example, the "Great Acceleration" graphs chart social and economic trends that point out notions of "mass consumption" (like McDonald's restaurants), but they fail to explain how people came to value consumerism.

[16] AESS 2014 Conference, "Welcome to the Anthropocene: From Global Challenge to Planetary Stewardship," Association for Environmental Studies and Sciences, http://www.aess.info/content.aspx?page_id=22&club_id=939971&module_id=154815 (accessed on 30 May 2015).

[17] Andrew Revkin, "Paths to the 'Good' Anthropocene," YouTube, 20 June 2014, https://www.youtube.com/watch?v=VOtj3mskx5k (accessed on 30 May 2015).

[18] For Hamilton's critique, see Clive Hamilton, "The Delusion of the 'Good Anthropocene': Reply to Andrew Revkin," www.clivehamilton.com, 17 June 2014, http://clivehamilton.com/the-delusion-of-the-good-anthropocene-reply-to-andrew-revkin/ (accessed on 30 May 2015); for Revkin's response, see Andrew C. Revkin, "A Darker View of the Age of Us – the Anthropocene," *New York Times*, Dot Earth Opinion, 18 June 2014, http://dotearth.blogs.nytimes.com/2014/06/18/a-darker-view-of-the-age-of-us-the-anthropocene/?_r=0 (accessed on 30 May 2015).

[19] Clive Hamilton, Christophe Bonneuil, and François Gemenne, "Thinking he Anthropocene," in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton, Christophe Bonneuil, and François Gemenne (New York: Routledge, 2015), 2-3.

[20] Joseph Stromberg, "What is the Anthropocene and Are We in It?" *Smithsonian Magazine*, January 2013, http://www.smithsonianmag.com/science-nature/what-is-the-anthropocene-and-are-we-in-it-164801414/?no-ist (accessed 28 June 2014); Elizabeth Kolbert, "Enter the Anthropocene—the Age of Man," *National Geographic*, March 2011, http://ngm.nationalgeographic.com/2011/03/age-of-man/kolbert-text/1 (accessed 1 July 2014); Paul Crutzen, "Geology of Mankind," *Nature* 415 (3 January 2002): 23.

[21] Will Steffen, Jacques Grinevald, Paul Crutzen, and John McNeill, "The Anthropocene: conceptual and historical perspectives," *Philosophical Transactions of the Royal Society A* 369 (31 January 2011): 843.

[22] Steffen et al., "The Anthropocene: conceptual and historical perspectives," 842-62; Will Steffen, Paul J. Crutzen, and John R. McNeill, "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?" *AMBIO: A Journal of the Human Environment* 36 (2007): 614-21.

[23] Ibid.; J.R. McNeill and Peter Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945* (Cambridge, MA: Harvard University Press, 2016).

[24] For Ruddiman's argument, see William F. Ruddiman, "The anthropogenic greenhouse era began thousands of years ago," *Climatic Change* 61 (December 2003): 261-93; and William F. Ruddiman, *Plows, Plagues, and Petroleum: How Humans Took Control of Climate*, Princeton Library Science Edition (2005; Princeton, NJ: Princeton University Press, 2010), 5-7.

[25] Jan Zalasiewicz et al., "When did the Anthropocene begin?: A mid-twentieth century boundary is stratigraphically optimal," *Quaternary International* 30 (January 2015): 196-203.

[26] For an excellent summary of the different starting dates for the Anthropocene, see Bruce D. Smith, and Melinda A. Zeder, "The onset of the Anthropocene," *The Anthropocene* 4 (June 2013): 8-13. For the Anthropocene working group, see "Working Group on the 'Anthropocene,'" Subcommission on Quaternary Statigraphy, http://quaternary.stratigraphy.org/workinggroups/anthropocene/ (accessed 26 January 2016).

[27] Alf Hornborg, "The political ecology of the Technocene: uncovering ecologically unequal exchange in the world-system," in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton, Christophe Bonneuil, and François Gemenne (New York: Routledge, 2015), 57-69.

[28] Timothy James LeCain, "Against the Anthropocene: A Neo-Materialist Perspective," *International Journal for History, Culture, and Modernity* 3 (2015): 1-24.

[29] Andreas Malm, "The Anthropocene Myth: Blaming all of humanity for climate change lets capitalism off the hook," *Jacobin Magazine*, 30 March 2015, https://www.jacobinmag.com/2015/03/anthropocene-capitalism-climate-change/ (accessed on 31 May 2015); Andreas Malm and Alf Hornborg, "A geology of mankind?: A critique of the Anthropocene narrative," *The Anthropocene Review* 1 (April 2014): 67.

[30] For additional critiques, particularly from Daegan Miller, see presentation videos from "The Anthropocene Slam: A Cabinet of Curiosities," Nelson Institute Center for Culture, History, and Environment, University of Wisconsin-Madison, 8-10 November 2014, http://nelson.wisc.edu/che/anthroslam/schedule/index.php (accessed on 31 May 2015).

[31] For another work that utilizes the Anthropocene as an interpretative frame, see Mark Boxell, "Rapid Ascent: Rocky Mountain National Park in the Great Acceleration, 1945-present" (Master's thesis, Colorado State University, 2016).

[32] Fernand Braudel conceives of a temporal schema split up on geographical, social, and individual time. See Fernand Braudel, *On History*, trans. Sarah Matthews (Chicago: University of Chicago Press, 1980), 4, 33.

[33] Sara B. Pritchard, "Joining Environmental History with Science and Technology Studies," in *New Natures: Joining Environmental History with Science and Technology Studies*, eds., Dolly Jørgensen, Finn Arne Jørgensen, and Sara B. Pritchard (Pittsburgh, PA: University of Pittsburgh Press, 2013), 6-8, 16-17.

[34] James B. Benedict, *The Game Drives of Rocky Mountain National Park*, Research Report No. 7, (Ward, CO: Center for Mountain Archeology, 1996), 1-2, 7-10, 76-77, Archeological Files, Rocky Mountain National Park Archives, Estes Park, CO (hereafter cited as ROMO Archives); James B. Benedict, "Footprints in the Snow: High-Altitude Cultural Ecology of Colorado Front Range, U.S.A.," *Arctic and Alpine Research* 24 (1992): 11-14, Archeological Files, ROMO Archives; Kevin P. Gilmore et al., *Colorado Prehistory: A Context for the Platte River Basin* (Denver: Colorado Council of Professional Archaeologists, 1999), 116-17; Elliott West, *The Contested Plains: Indians, Goldseekers, and the Rush to Colorado* (Lawrence: University Press of Kansas, 1998), 23-25.

[35] Jo Guldi and David Armitage argue that the present crisis of short-termism necessitates that historians return to the *longue dureé* in their writings. The pair mentions that Deep History is a favorable method for implementing long-term narratives. See Jo Guldi and David Armitage, *The History Manifesto* (Cambridge, UK: Cambridge University Press, 2014), 4-13, 118.

[36] For the Laramide Orogeny process, see Keith Heyer Meldahl, *Rough-Hewn Land: A Geologic Journey from California to the Rocky Mountains* (Los Angeles: University of California Press, 2011), 189-95; Ted Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002), 4-6; Joseph M. English and Stephen T. Johnston, "The Laramide Orogeny: What Were the Driving Forces?" *International Geology Review* 46 (2004): 833-37; and Jeff Rennicke, *The Rivers of Colorado* (Billings, MT: Falcon Press, 1985), 18-19.

[37] Meldahl, *Rough-Hewn Land*, 90-96, 165-204; Scott A. Elias, *Rocky Mountains* (Washington, D.C.: Smithsonian Institution Press, 2002), 16-22; Richard Cannings, *The Rockies: A Natural History* (Vancouver, BC: Greystone Books, 2005), 38-39.

[38] "Arapaho," in *Encyclopedia of American Indian History*, Vol. 4, eds. Bruce E. Johansen and Barry M. Pritzker (Santa Barbara, CA: ABC-Clio, 2008), 1158-59; Pekka Hämäläinen, "The Rise and Fall of Plains Indian Horse Cultures," *Journal of American History* 90 (December 2003): 839-40; Elizabeth A. Fenn, *Pox Americana: The Great Smallpox Epidemic of 1775-82* (New York: Hill & Wang, 2001), 196-223; Oliver W. Toll, *Arapaho Names and Trails: A Report of a 1914 Pack Trip* (Denver, CO: privately printed, 1962), 11-13, Native

American Interpretative Files, ROMO Archives; Ralph L. Beals, *Ethnology of Rocky Mountain National Park: The Ute and Arapaho* (Berkeley, CA: U.S. Department of Interior, 1935), 1-3, 16, Native American Interpretative Files, ROMO Archives; James B. Benedict, *Old Man Mountain: A Vision Quest Site in the Colorado High Country*, Research Report No. 4 (Ward, CO: Center for Mountain Archeology, 1985), 2-6, 32-33.

[39] Meldahl, *Rough-Hewn Land*, 165-82; David M. Cairns, David R. Butler, and George P. Malanson, "Geographic Setting of the Rocky Mountains," in *Rocky Mountain Futures*, ed. Jill S. Baron (Washington, D.C.: Island Press, 2002), 27-36; Howard Ensign Evans and Mary Alice Evans, *Cache la Poudre: The Natural History of a Rocky Mountain River* (Niwot: University Press of Colorado, 1990), 7-14; Rennicke, *The Rivers of Colorado*, 19.

[40] Rennicke, *The Rivers of Colorado*, 54-56; Daniel Tyler, *The Last Water Hole in the West: The Colorado-Big Thompson Project and the Northern Colorado Water Conservancy District* (Niwot: University Press of Colorado, 1992), 158-60; James H. Pickering, *America's Switzerland: Estes Park and Rocky Mountain National Park, the Growth Years* (Boulder: University Press of Colorado, 2005), 13-20; McComb, *Big Thompson*, 3-8.

[41] A. E. Sprague, "Pioneering on the Big Thompson and in Estes Park," *Colorado Magazine* 12 (May 1935): 92-97, Stephen H. Hart Research Library, Colorado Historical Society (hereafter cited as CO-HIST); Robert Follansbee and Leon R. Sawyer, *Floods in Colorado*, Water-Supply Paper 997 (Washington, D.C.: Government Printing Office, 1948), 46-49; A.E. Sprague, "My First Visit to Estes Park," 64-68, Manuscript Collection #597, CO-HIST; A.E. Sprague, "Transportation," 48, Manuscript Collection #597, CO-HIST; Abner E. Sprague, *My Pioneer Life: The Memoirs of Abner E. Sprague* (Estes Park, CO: Rocky Mountain Nature Association, 1999).

[42] Orsi, *Hazardous Metropolis*, 3-8; Stephen Sitch and Francis Drake, "The changing water cycle," in *Water Resources: An Integrated Approach*, ed. Joseph Holden (New York: Routledge, 2014), 19-30; Timothy G.F. Kittel et al., "Climates of the Rocky Mountains: Historical and Future Patterns," in *Rocky Mountain Futures*, ed. Jill S. Baron (Washington, D.C.: Island Press, 2002), 59-67.

[43] Orsi, *Hazardous Metropolis*, 3-8; Sitch and Drake, "The changing water cycle," 19-30.

[44] Joseph Holden, "River basin hydrology," in *Water Resources: An Integrated Approach*, ed. Joseph Holden (New York: Routledge, 2014), 66-76 and Jacquie Annand, "Evaluating the environmental losses and benefits from flooding" paper, Royal Melbourne Institute of Technology, Australia, 20 June 2008, http://mams.rmit.edu.au/kse6lzj09fet.pdf (accessed on 4 January 2015); McComb, *Big Thompson*, 9; Ari Kelman, *A River and Its City: The Nature of Landscape in New Orleans* (Berkeley: University of California Press, 2003), 1-5, 187-96; Orsi, *Hazardous Metropolis*, 168-169; Mark Cioc, *The Rhine: An Eco-biography, 1815-2000* (Seattle: University of Washington Press, 2002), 5, 195; Follansbee and Sawyer, *Floods in Colorado*, 46-49.

[45] James Soule, William P. Rogers, and David C. Shelton, "Geological Hazards, Geomorphic Features, and Land-Use Implications in the Area of the 1976 Big Thompson Flood, Larimer County, Colorado," *Environmental Geology* 10 (Denver: Colorado Geological Survey, 1976), Morgan Library, Colorado State University, Fort Collins, CO. On the geophysical controls of the Rockies, see Jill S. Baron, ed., *Rocky Mountain Futures* (Washington D.C.: Island Press, 2002), 25. Ted Steinberg defines historical agency as "the question of how much efficacy human beings have had in shaping their lives and that of society around them." He argues, and I agree, that natural forces must be taken seriously as historical actors. For more on the complication of agency, see Steinberg, *Down to Earth*, 283-85; and Richard C. Folz, "Does Nature Have Historical Agency? World History, Environmental History, and How Historians Can Help Save the Planet," *The History Teacher* 37 (November 2003): 9-13, 20. Folz suggests that "Historians need to stand up and challenge the technological optimists of today who blithely assert that humans have always triumphed over adversity in the past and will therefore rise to the challenges of the present and future." For a view that extends the idea of "agency networks," see Linda Nash, "The Agency of Nature or the Nature of Agency," *Environmental History* 10 (January 2005): 67-69. For a critique of "nature's agency," see Paul S. Sutter, "A World with Us: The State of American Environmental History," *Journal of American History* 100 (June 2013): 97-98.

[46] McNeill, *Something New Under the Sun*, 3-20.

[47] Edmund Burke III, "The Big Story: Human History, Energy Regimes, and the Environment," in *The Environment and World History*, eds. Edmund Burke III and Kenneth Pomeranz (Berkeley: University of California Press, 2009), 33-51.

[48] Kristin Browning-Blas and Zahira Torres, "Floodwater tear away huge swaths of Larimer County mountain roads," *Denver Post*, 13 September 2013, http://www.denverpost.com/breakingnews/ci_24088546/colorado-flood-bridges-closed-fort-collins-loveland-by (accessed on 13 April 2015).

[49] Kevin Duggan, "Recovering after rivers rage," *Fort Collins Coloradoan*, 5 September 2014, http://www.coloradoan.com/story/news/local/2014/09/05/september-flood-anniversary-colorado/15151647/ (accessed on 14 April 2015).

[50] Steffen, Crutzen, and McNeill, "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?" 618-20.

[51] Adrian Howkins, "Experiments in the Anthropocene: Climate Change and History in the McMurdo Dry Valleys, Antarctica," *Environmental History* 19 (April 2014): 294-302; Georgina H. Endfield, "Exploring Particularity: Vulnerability, Resilience, and Memory in Climate Change Discourse," *Environmental History* 19 (April 2014): 303-10.

# CHAPTER ONE

## ACCELERATING ROAD-BUILDING, ACCELERATING CARS

On the Saturday afternoon of May 28, 1938, some five-hundred Coloradans eagerly gathered at the foothills of the Rocky Mountains. They had assembled at the mouth of the Big Thompson Canyon to celebrate the formal dedication of U.S. Highway 34. The modern road traced a ribbon of asphalt through this narrow gorge alongside the Big Thompson River from the low-lying town of Loveland to the high-country retreats of Estes Park and Rocky Mountain National Park. At around 3 p.m., throngs of citizens and dignitaries congregated in front of a raised platform near the banks of the river. On the stage, engineer Charles Vail, chief designer of the road project, and Governor Teller Ammons offered an opening address and asked their audience to consider how this "engineering dream" would draw ever-increasing tourist traffic. Vail and Ammons then led the crowd to a specially-constructed gate at the craggy walls of the canyon entrance to close the ceremony. As the geologic presence of the Narrows loomed overhead, the duo used a three-foot-long key to unlock an equally-oversized padlock, suggesting their immense powers to "unlock" this route for future automobile travel. "When we consider that it took nature thousands of years, maybe hundreds of thousands, to make this beautiful can[y]on," Governor Ammons boasted, "we can realize that we are making progress when we see this fine highway thru [*sic*] the can[y]on."[1]

Ammons's comments during the dedication ceremony reveal a stark comparison. He juxtaposed the engineering powers of construction laborers, who had erected a paved road within canyon over *years*, to the erosive powers of river and glacial activities, which had formed the canyon itself over *millennia*. From the last Ice Age—the Pleistocene—into the present, the Big

Thompson River had carved and molded its watercourse through the eastern slopes of the Rockies. From late-1932 to mid-1938, however, Vail and the Colorado State Highway Department oversaw road-building crews as they chiseled through layers of granite, gneiss, and other geologic features to construct the modern highway. Both entities were forces of nature in the governor's mind; and both moved enormous amounts of rock and rubble in the process. By equating these road architects to river and glacial effects, Ammons was in essence bragging about a nascent form of *geophysical agency*.[2]

One defining hallmark of the Anthropocene has been the humans' collective status as a geophysical agent. In the Earth sciences, geophysical agency is best understood as the ability to move geologic matter. The geomorphologist Roger Hooke has commented, "All geomorphic processes that alter the landscape, do so by moving earth."[3] Humans became earthmovers, too. Geoscientists have estimated that human activities over the Great Acceleration—mainly through industrial agriculture, mine quarrying, and most important to this chapter, road construction—moved between thirty and forty-five gigatons of geologic material annually.[4] At this rate, the combined amount of rock, gravel, and dirt would completely fill up the Grand Canyon in only fifty years.[5] In contrast with small streams or large rivers, the Big Thompson River somewhere in the middle, watercourses have transported between fourteen and thirty-nine gigatons yearly. Not only that, but glaciers of the last Ice Age, the ones within Rocky Mountain National Park included, have carried around ten gigatons of rubble annually while these ice sheets carry about 4.3 gigatons today.[6] Year in and year out, human undertakings removed, relocated, or repurposed more of the Earth's crust during the Great Acceleration than *all* other material forces.[7] At least on the surface, Ammons had correctly declared that Anthropocene agency was roughly equivalent to Holocene water or Pleistocene ice.

But underneath it all, Ammons was wrong. Humans *by themselves* were not earthmovers. During 1930s highway construction in Colorado's Big Thompson Canyon, geophysical agency depended on the entangled reality of concentrated capital, technological machinery, fossil fuels, and a certain engineering mentality.[8] Highway planners conceived of this New Deal roadway project both to employ downtrodden Americans during the Great Depression and to encourage automobile tourism with the convenience of modern transportation infrastructure. These work-relief programs relied on massive injections of public monies, which assisted private companies in generating a car-oriented landscape within the United States. While New Deal-era roadways were nationally-inclusive, the transportation networks and knowledge systems that bolstered them reached out much farther. By modifying geologic material within the gorge, road-building crews not only erected a substantial thoroughfare between the canyon walls, but to this end, they altered the form and function of the Big Thompson River. To accomplish this feat, highway engineers utilized a hydrocarbon energy regime in order to augment the biophysical corporeality of construction labor. Workers' bodily power merged with the fossil fuel-driven mechanical power of bulldozers, shovelers, and jackhammers, enabling humans to become *akin* to a geophysical force—a force characteristic of the Anthropocene.[9]

### *The New Deal and Nature*

In a 1932 issue of *Colorado Highways*, Frederic E. Everett, president of the American Association of State Highway Officials, worried about the future of public roads. "To operate the gigantic highway-automobile transportation system that we have built up requires large sums of money," Everett wrote, "but I know of no activity wherein greater value is received." In a similar piece, the leader of the American Road Builders' Association, W.R. Smith, advised that the "investment of public money must be maintained at proper working efficiency…to reduce the cost of transportation as well as to facilitate the speed and comfort of travel." Like many state-run engineering magazines, *Colorado Highways* lobbied the national government for increased financial support during the global economic downturn of the 1930s in order to construct new highways or renovate existing ones. These publicists also highlighted the fact that geomorphic activities, road construction in this particular case, was contingent upon a political economy focused on capital.[10]

In the midst of the Great Depression, the United States government looked for ways to make these calls-to-action a reality and to put Americans back to work. In 1933, when recently-elected President Franklin D. Roosevelt stepped into office, one-quarter of the entire American workforce, some thirteen million laborers, was jobless; and another one-quarter was seriously underemployed. Roosevelt, in concert with U.S. Congress, sought to provide assistance to struggling citizens through a series of federal programs called the New Deal. This legislation partly comprised of bureaucratic schemes for massive infrastructure—such as large dam works or extensive road systems—meant to rearrange the material world in order to restore a capitalist economy. The New Deal, overall, embodied an attempt to rehabilitate American industrial society, and it increasingly resulted in automobile-centered landscapes.[11]

As a measure of the New Deal, Congress passed the National Industrial Recovery Act (NIRA) on June 16, 1933. NIRA allocated a whopping \$3.3 billion to be spent on earthmoving endeavors such as bridge construction, flood control, harbor improvement, and other types of infrastructure development. From this lump sum, NIRA included provisions that apportioned "not less than four-hundred million dollars, to be expended" towards the "Construction, repair, and improvement of public highways and park ways." The law allotted federal dollars to work in conjunction with the Federal-Aid Highway Act of 1921, which stipulated that the national legislature would match state governments, through gasoline and vehicle taxes, at a fifty-fifty percent rate for highway construction. These funds would be administered through the federal Bureau of Public Roads. With this money-laden program in place, the viability of engineering highways during the Great Depression materialized for numerous states on the cusp of the Great Acceleration.[12]

In Colorado, state highway engineer Charles Davis Vail wanted to put federal dollars to geophysical work through road-building. Governor William H. Adams found Vail, a two-time graduate of the University of Illinois and a skilled railroad civil engineer, well-suited for the position and appointed him to the job in November 1930. Vail, an ambitious and hard-headed director, would be later characterized by an associate as "blunt, undiplomatic, tough as leather," and someone who "never dodged a fight or an issue." He was also a classic technocrat who believed that technical expertise and the rational application of engineering could overcome any material obstacle. Vail used his domineering personality to his advantage and convinced the Colorado state legislature to raise matching funds for the construction of new highways. By the time Vail would be finished, he had grabbed a considerable share of federal dollars through NIRA—$6,874,530 to be exact—to be matched by the Colorado legislature at nearly $14 million for road production.[13]

Using these newly-acquired funds, Vail decided that carving modern highways into the high country of the Rocky Mountains would be a sound Depression-era investment. Vail and the Colorado State Highway Department developed a highway plan that would construct six major expressways leading into the Rockies, including one proposal to revamp a dilapidated, gravel road within the Big Thompson Canyon. Back in the early 1900s, local business interests financed construction of a single-lane motorway from the plains of Loveland to the mountain destination of Estes Park. State officials upgraded the road in the following decades—mainly by widening and reinforcing—to expedite travel to the eastern entrance of the newly-established nature reserve, Rocky Mountain National Park (RMNP), founded in 1915. Yet traveling along the route still took considerable time as motorists navigated the steep grades and difficult geophysical features. Piloting bumpy roads, steering through hairpin curves, and honking automobile horns at blind bends made the passage uneasy for drivers and passengers alike. A new motorway, the state engineer claimed, would transform this local canyon and serve as the main link for recreationalists to the national park from the Colorado plains and beyond.[14]

When finished, the proposed 25-mile stretch of road—renamed U.S. Highway 34—would further integrate Estes Park and RMNP into regional and national car-oriented landscapes. The new roadway would immediately complement the existing National Park-to-Park Highway. Built in the late 1910s, this transportation route encompassed twelve major national parks and monuments in a circular loop through the American West. The expressway would shore up easy access to RMNP along this route for either travelers headed northward from Grand Canyon National Park in Arizona or going southward from Yellowstone National Park in Wyoming.[15] Once completed, the modern highway would also become the culminating link of a coast-to-coast automobile route. Motorists could have conceivably driven from multiple eastern points to Chicago, and then over the Great Plains to the foothills of the Rocky Mountains. From there, they could have traveled through the Big Thompson Canyon up to Estes Park, and over the twelve-thousand-foot-tall Continental Divide on recently-constructed Trail Ridge Road in RMNP. Finally, a driver could have cruised across the Colorado Plateau and Great Basin to San Francisco, or as a newspaper writer imagined, "into the setting sun on its way to the Pacific

Ocean."[16] The modern highway—so it was argued—would place the Estes Park region at the intersection of "the entire Rocky Mountain playground."[17]

As the United States built and unified an east-west path, international plans for a north-south route were hammered out at the Inter-American Conference for the Maintenance of Peace. On December 23, 1936, the U.S. and twenty Latin American countries "agree[d] to collaborate, with all diligence and by all adequate means, in the speedy completion of a Pan-American Highway."[18] While the superhighway was originally meant to extend only from the Texas border to Buenos Aires in order to stimulate "the exchange of the products," it would eventually encompass a whole lot more.[19] By twentieth century's end, the Pan-American Highway would informally stretch from the Arctic Circle in Alaska, extending down parallel to the Front Range in Colorado on Interstate-15, and ultimately to Tierra del Fuego in Chile and Argentina.[20] One intersection on this intercontinental highway stood not even ten miles away from the mouth of the Big Thompson Canyon. Leaving the mountain gorge, a motorist could have driven for over three thousand miles northward or almost ten thousand miles southward. Besides a small, fifty-mile gap in Panama and Columbia, the vehicle would have never left the asphalt or concrete for the entire trip.[21] The construction of U.S. Highway 34, then, was beyond just a local New Deal scheme enclosed within national borders. During the Great Acceleration, it became part of a much bigger—indeed hemispheric—transportation system too. And at the physical intersection of this multicontinental highway network was engineer Charles Vail.

### *The Engineer and Technical Expertise*

Journalist Lee Casey reflected on the career of Charles Vail in a 1943 edition of the Denver-based newspaper, *Rocky Mountain News*. Casey remarked that Vail, during his thirteen years as chief highway engineer for the Colorado State Highway Department, “has defied public opinion, ignored the civil service amendment to the [state] Constitution, either bulldozed or cajoled governor after governor, without being called into account.” By this time, Vail had come under verbal assault by government officials and newspaper reporters for his reckless administration of a quarter-billion-dollar budget with little to no oversight. “By his aggressive personality and vast sums he controlled,” Casey proceeded, “Mr. Vail was able to establish himself as the chief political power in the state.” With hardly any options for recompense until Vail retired his post, Casey concluded, “So the highway dictator remains.”[22]

Vail developed quite the reputation within Colorado during his tenure. Politicians and businessmen alleged that Vail “ruled like a czar.”[23] Others held that Vail “rubbed people the wrong way” and “his brusqueness often made him enemies.”[24] Engineering colleagues addressed Vail solely as “Chief” or “Boss.” Speaking to the eight-fold expansion of Colorado highways under Vail’s lengthy reign, one contemporary even remarked that “Chas. D. Vail was an institution.”[25] The notoriety that Vail had established, in reality, owed much to the knowledge systems that had begun to develop between the nineteenth and twentieth centuries. During this time, engineering as a standardized profession marked a transition towards university-trained education. It was believed that the more expertise that one attained, the more technical authority one likely achieved, and the more command one supposedly possessed over people and nature. This engineering paradigm, which developed for Vail with railroads during phase one of the Anthropocene, aided in unleashing a similar logic for highway-building on the verge of the Great Acceleration. Charles Vail, with his education and technical expertise, serves as a case study for this approach and its consequences.[26]

Engineering is as old as human civilization; but as a professionalized career, it is much younger. Demand for the engineer's trade swelled during the latter parts of the nineteenth century as it became synonymous with economic progress. Railroads, canals, mines, and skyscrapers—all symbols of industrial prowess at the time—had to be engineered in some fashion or another. With this mounting interest came a gradual shift in engineering education from experiential, apprentice-based learning towards more formalized instruction. The growth in American engineering schools—supported by the Morrill Land-Grant Act of 1862—reflected this trend: only two university programs in 1840 escalated to seventy departments by 1870, eighty-nine by 1900, and 139 by 1934.[27] Membership in professional societies, which frequently upheld the educational standards for civil engineers, expanded across much of the Western world as well. In the United States, an estimated 250 members in 1870 increased to 5,300 affiliates by 1910; in England, 1,600 enlarged to 8,850; in Germany, 3,550 skyrocketed to 9,800; and in France, 1,000 swelled to some 7,000.[28] The men who formed these associations (and they were almost always men) occasionally traveled to international conferences in order to share ideas and instruction. As a member of the American Society of Civil Engineers since 1900, an organization that had already featured 341 affiliates from five different continents only ten years later, Vail was caught up in this global technocratic revolution.[29]

Born September 11, 1868, in Lone Tree, Illinois, Vail decided to attend an undergraduate institution in his home state with sterling engineering repute—the University of Illinois. In 1891, at twenty-three-years old, he wrote a Bachelor's thesis, "Tensile Strength of Portland Cement & Lime in Mortar," and was conferred a degree by the engineering college.[30] The same year Vail graduated, engineer Arthur Wellington released the fifth edition of his popular training manual, *The Economic Theory of the Location of Railways*. The book likely shaped Vail's education in one way or another, stressing that the physical design of transportation infrastructure was first and foremost meant to enhance movement so as to increase commercial revenues.[31] Vail reinforced his newfound knowledge through work experiences with railroad companies: the Union Pacific in Wyoming and Utah; the Trinity, Cameron, & Western in Texas; the Mexican International; the Oregon Short Line; and the Chicago, Milwaukee, & St. Paul. After switching to public waterworks construction in Montana and Canada for a short time, Vail finally made Denver, Colorado, his permanent home in 1908. Vail took on various projects for several years; and in 1917, he was appointed as engineer for the public utilities commission by the state government. Vail held the position until 1930, when he became chief highway engineer for the Colorado State Highway Department, a commanding role he would hold until his death.[32]

Figure 1.1. Charles Davis Vail, chief highway engineer for the Colorado State Highway Department from November 1930 until his passing in January 1945. *Rocky Mountain Contractor*, January 12, 1938. Courtesy of Gemmill Library, University of Colorado-Boulder.

Vail's graduate work, in particular, offers insights into the construction of U.S. Highway 34 and the engineering mindset of the time. While supervising the Big Thompson Canyon route in 1936, Vail finished a Master's degree in civil engineering at his undergraduate alma mater. Vail completed a thesis again, suitably entitled "Highway Location in the Foothills of the Rocky Mountains in a Cloudburst Area."[33] This study—likely influenced by his concurrent road-building projects—detailed a pending scheme for highway construction within the Clear Creek Canyon between Golden and Idaho Springs, Colorado. This site was located about seventy-five miles directly south of the Big Thompson Canyon. Although the thesis did not include any specific details about U.S. Highway 34, the similarities in geography, topography, and hydrology between the constructed and proposed roads in these two canyons has provided an understanding of how Vail thought. Originating from his railroads background, Vail would demonstrate how an economics-driven, utilitarian logic, or what historian Donald Worster has called "instrumental reason," influenced his design of highways.[34]

In the thesis itself, Vail was painfully aware how recurring inundations overwhelmed the Big Thompson Canyon and other mountain gorges along Colorado's Front Range. Vail noted of these geomorphic forces in his introduction:

> In the foothills region, generally during the summer months, moisture-laden air suddenly deflected upward by the mountains, frequently results in torrential precipitation or cloudburst conditions. The storm-water runoff becomes concentrated quickly in the can[y]on-bound creeks, which, because of steep grades, become raging torrents possessing tremendous erosive power.[35]

Vail was also cognizant of the impacts wrought by modern transportation infrastructure. He stated, for instance, that road-building "procedure[s] will necessitate the encroachment upon the creek channel in many places by varying amounts."[36] The "flood menace," as Vail often called it, could be eluded with technological fixes, however. Vail reasoned that "it i[s] obvious that the highway plan must provide extensive and adequate bank protection" with "very substantial walls or riprap [to] be constructed to protect the fill. Otherwise it is inevitable that the highway will be frequently and at times very materially damaged by floods resulting from cloudbursts in the can[y]on."[37] Vail continued, tragically ironic in retrospect to later deluges, that "highway location in cloudburst areas present distinct problems which must be solved if disaster and loss of life are to be avoided."[38] Although inundations may occur, Vail believed that technology would mitigate this problem.[39]

Economics, not ecology, guided road-production for Vail. "Modern highway construction based on careful analysis of the various possible locations with special attention to their relative advantages and disadvantages from engineering and economic points of view is imperative," Vail wrote.[40] Within this vein, he dedicated much of his thesis to maximizing "traffic volume," which entailed using statistical data to determine how to get as many cars as feasible onto the road. Regardless of how these rivers coursed through their canyons, straight and wide lanes proved to be the most economical for increasing automobile capacity and speed. "The principle item of cost in this case," Vail argued, "would appear to be the loss of time due to the reduced speed at curves."[41] In this process, Vail distilled these dynamic ecosystems down to schematic representations: the planning of roads became an exercise of technical abstractions. From a techno-economic viewpoint, Vail converted these river canyons into what political scientist James Scott has called "legible" landscapes, replacing environments of complexity and interconnectedness with those of engineered order and simplicity.[42]

Instead of following the vagaries and contours of natural landscapes, engineers like Vail often sought the most legible routes, that is, the most direct ones. New Deal highways carved through Colorado's mountains just as the Nazi autobahn sliced across the German countryside. Both governments constructed thousands of miles during the 1930s. Expressways of this kind worked best for moving people and goods, for spurring on economic growth, and for propelling forward a Great Acceleration in human activities. In any case, Vail was just one person among many who carried a despotic personality and instrumental reasoning to realize their goals. From urban-planner Robert Moses of the New York metropolitan area, to dam-builder Floyd Dominy of the U.S. Bureau of Reclamation, to road-designer Fritz Todt of Germany's Third Reich, men of this character-type would become more influential during the Anthropocene. They directed mass society toward more technocratic ends. Although in charge of Colorado's highway-building projects, Vail himself would not touch the wooden handle of any shovel or the steel clutch of any bulldozer at all. Rather, construction laborers and industrial machinery sputtered and moaned, clanked and grinded, merging together into a single geophysical force.[43]

*Energy Regimes and Earthmovers*

The human and mechanical energy required to build a modern highway within the Big Thompson Canyon would be substantial. The engineering firms recruited between fifty and two-hundred men at a time to test muscle and bone as they performed road-production tasks. Most of the workers were local Coloradans, especially common laborers, although the construction companies brought in a few out-of-staters, including one group from Texas, to run specialized machinery. At least half of all laborers were taken from unemployment "relief rolls." The construction project paid $0.50 an hour to unskilled laborers, or those "linemen" who shoveled rocks and raked concrete; intermediate laborers, who handled jackhammers and drove trucks powered by diesel-fuel engines, earned $0.70 an hour; and skilled laborers received $1.10 an hour for operating hydrocarbon-burning bulldozers, shovelers, and other heavy equipment. The workers' pay scale reveals a paradox central to industrial America's mineral-based, fossil-fuel economy that reinforced valuing technical skill over physical toil: the more organic energy one had to exert on the job, the less monetary compensation one actually received.[44]

The wage differences that confronted these road workers were the byproducts of a relatively novel energy regime. Each time construction laborers drilled into the canyon rock, power-shoveled a heaping pile of dirt, or hauled off truckload after truckload of rubble, they tapped into the energy sources of borrowed time. In the deep past, hundreds of millions years ago, dead organic matter—phytoplankton, plant leaves, and animal excrement, for example—collected in the oxygen-deprived recesses of swamps and the ocean. Encased in layers of sediments over time, pressure and heat gradually transformed these mixtures of peat and sludge into the substances that humans would later come to know as coal and oil. Dispersed across the planet, these subterranean stores of hydrocarbons—comprised of mostly carbon and some hydrogen—offered dense reserves of solar energy captured from eons and eons prior. These workers, in effect, relied on past geologic processes in order to become geophysical agents in the present.[45]

This finite supply of fossilized fuels had been useless to humans for millennia. Like the energetic system that Archaic, Arapaho, and Anglo peoples had tapped during the Holocene epoch to move through the canyon, an ancient-organic energy regime ruled the planet. Human and animal muscles did most of people's work—with power derived from the caloric intake of plants and animals, all of which ultimately procured that energy from the Sun. Domesticated agriculture allowed human societies to amass larger reserves of energy in the form of foodstuffs such as cereal grains and pork flesh. Trade networks between Old and New Worlds opened up new items of energy to be exploited. The burning of organic matter was equally important for humans. Domesticated fire offered light for dark places, flames to fend off predators, warmth against the cold, heat for cooking palatable meals, and eventually, combustion for an energy revolution.[46]

Only when people discovered how to capture hydrocarbons for mechanized power did the resource become more accessible. Building off the Savery and Newcomen devices, Scottish inventor James Watt built a steam engine in the eighteen century that more effectively burned fossil fuels, which, in part, stimulated Western industrialization and its ever-expanding appetite for coal. Nearly one hundred years later, French engineer Jean J.E. Lenoir and German designer Nikolaus Otto similarly established oil's place in the global economy with scientific innovations that produced the petroleum-powered internal combustion engine.[47] Relying upon these works, American industrialist Benjamin Holt resolved a common problem during the early-twentieth century after witnessing how heavy tractors often sank into California's soft farmlands. In 1904, Holt decided to replace the machinery's standard, gasoline-driven wheels with a belted crawler track, to which one commentator remarked: "If that don't look like a monster caterpillar." Some twenty years later, the Holt Manufacturing Company merged with one of its competitors to form the Caterpillar Tractor Company. At about this same time, Caterpillar turned its focus towards selling earthmoving products and began exporting them for state, colonial, and military projects throughout the world.[48]

The Colorado State Highway Department became just one of many beneficiaries from these road-production technologies. Construction crews working on U.S. Highway 34 at any one time utilized numerous industrial machines: one to three bulldozers of Caterpillar Sixty, Forty, or Thirty models; one to three tractors of various Caterpillar varieties; one to three power shovels (with 1- to 1½-cubic-yard-sized buckets) manufactured by Midwestern companies of Bucyrus-Erie, Thew-Lorain, or Koehring; five to six 1½-ton dump trucks; three to four 5-ton dump trucks;

two to ten Ingersoll-Rand jackhammers; one to four air compressors; one to two 2-sack concrete mixers; one 12-feet-wide grader attachment; and one to two steamrollers. Engineers within the Colorado State Highway Department regularly anthropomorphized these machines, giving them bodily functions and blurring the lines between humans and technology. Referring to excavation work by a gasoline-driven shoveler, for example, technocrat D.S. Moore stated that high-quality fill "material requires *handpicking* to remove large rocks." In reality, it was these construction technologies—powered by fossil fuels—that paved the way for modern highways.[49]

The replacement of human and animal power with fossil fuel combustion was both liberating and enslaving. Its embrace shattered the energy bottleneck that had limited human activities for centuries. The mass production of automobiles and highways—supporting a greater freedom in transit—would have been an impossible task without oil. Even so, the utilization of hydrocarbon energy also meant that society went to even greater lengths in order to fuel the boom. The petroleum wells in Pennsylvania, Texas, Oklahoma, and California, much of which were enveloped within John D. Rockefeller's gargantuan oil conglomerate, the Standard Oil Company, attest to the United States' growing reliance on fossil fuels.[50] In 1900, for instance, American oil fields generated only 174,000 barrels of crude petroleum a day. But by the mid-1930s, with highway projects like the Big Thompson Canyon route underway, U.S. wells surpassed the daily production rate of three million barrels. American petroleum extraction, similar to many other parts of the globe, continued to soar during the Great Acceleration: over six million barrels per day in the mid-1950s, and over eight million barrels per day by the mid-1970s.[51] An independence in travel necessitated a dependence upon fossil fuels.

The amount of work that was accomplished by fossil-fuel technologies compared to human labor alongside the Big Thompson River demonstrates the revolutionary difference in an ancient-organic versus hydrocarbon energy regime. A healthy, middle-aged adult male steadily contributed 0.1 horsepower of energy towards construction-related activities, such as raking or shoveling, and supplied 1.2 horsepower in short, periodic bursts. In contrast, a Caterpillar Sixty tractor, which received its namesake for its sixty-horsepower engine, provided a 600-fold increase in energy output in relation to one highway laborer. Barring mechanical breakdowns, this heavy equipment tired only when diesel supplies ran short and maintained an exponentially higher work-rate. As an illustration, it would have taken six hours for one hundred men to accomplish the same amount of hard-rock excavation as it took a single hour for a lone Caterpillar bulldozer. This fundamental revolution in energy systems allowed humans to become a geophysical force characteristic of the Anthropocene. Instead of struggling against geologic features like in times past, construction laborers used powerful hydrocarbons to level them.[52]

The entrenchment of an energy regime based on coal and oil (and eventually natural gas) was the defining step in categorizing humans as a geomorphic power. In order to prepare the Big Thompson Canyon for a modern transportation corridor, road-building crews and their fossil fuel-driven equipment excavated a total of at least 372,397.2 cubic yards of earth.[53] To place this figure into perspective, the cumulative amount of rock, gravel, and dirt weighed some 465,500 tons and could have filled approximately 115 Olympic-sized swimming pools. A newspaper columnist boasted about what "has taken the Big Thompson river centuries to [c]ut into the unyielding granite" now conceded to "the new ribbon of highway" in only a few short years.[54] Humans as earthmovers, however, takes on even deeper significance when generalized to a planetary scale. Geographer Dov Nir has noted that for every one-half mile of newly-constructed motorway, it produces, on average, 450 to 500 tons of human-caused erosion. Nir also estimated that, by the year 1980, mine quarrying in all forms had moved more terrain than did the natural processes of wind, water, and ice.[55] It is reasonable to assume, given the rapid global increase of highways over the Great Acceleration, that road production likely—if not certainly—paralleled this trend. Humans and hydrocarbons, nevertheless, would result in sizeable changes to the Big Thompson River.

### *A Road and a River*

In the early morning hours of November 6, 1936, the construction laborer Earl Gainsforth jackhammered into the solid rock of the Big Thompson Canyon. Gainsforth's duty, with the help of his fellow "relief roll" comrades, was to grade a smooth path into the daunting Colorado landscape for a future asphalt expressway. At 7:10 a.m. Gainsforth directed his jackhammer, driven by a diesel-powered air compressor, towards an area that, unbeknownst to him, contained "a charge of dynamite which had evidently failed to discharge in [a] previous blast." When his machine struck the envelope of nitroglycerin, it exploded, projecting chunks of rubble onto the ground and into the Big Thompson River. As the dust and debris settled, Gainsforth writhed in agony. "The shot hit him in the face," a supervisor observed, "and destroyed one eye and injured the other."[56]

The accident reveals one intimate moment in the collision of humans and hydrocarbons, of money and machines, of geophysical agency in the Anthropocene. As road-production crews advanced through the construction process, the Big Thompson Canyon underwent substantial changes. Each stage of building highway infrastructure—often instigated by some combination of canyon geology, hydrocarbon technology, and engineering ego—required alterations to the Big Thompson River in order to accommodate U.S. Highway 34. These types of earthmoving activities gave Vail and Ammons good reason to believe in their geomorphic status. And yet

Gainsforth's mishap demonstrates that geophysical powers were far more tenuous than the engineer or governor assumed. Highway workers, even with their heavy equipment, could never pacify the river as engineers desired. In fact, most phases of construction had the opposite effect. While the unstable alliance of capital, labor, technology, and fossil fuels supported ideas of high geological rank, the modern road actually transformed the mountain river into a more powerful geophysical agent.[57]

The Colorado State Highway Department commenced "Federal Aid Project No. 9-R" on paper in 1932 by announcing the invitation for construction bids from private contracting firms. When the project finally got moving in 1933 from a large dose of New Deal monies, Vail and other state engineers would oversee hired companies as they built the newly-integrated portion of U.S. Highway 34 in smaller sections, usually in one- to three-mile segments, from Loveland to Estes Park. After weighing the submitted options, Vail chose five construction businesses to complete respective sections of highway in the Big Thompson Canyon: Hamilton & Gleason, Sacra & Watts, Lowdermilk Brothers, and Gordon Construction, all from Denver, as well as W.A. Colt & Sons of Lyons, Colorado. Injecting these private companies with public support, the preliminary estimated cost to craft the modern highway within the mountain gorge was a sizeable $700,000.[58]

Before construction crews could complete any serious work, state highway engineers surveyed the proposed route and acquired right-of-ways. Vail and his assistants, while conforming to some topographical features, nonetheless chose the straightest possible lines within the canyon—eliminating sharp curves and difficult grades—to aid future motorists' speed and comfort. Their motivations likely matched those of a 1934 civil engineering textbook: "The economist demands the straightest road that can possibly be secured…."[59] These technocrats largely disregarded, though, where the road transected homes and river, imposing significant modifications to both human property and stream hydrology.[60] The biggest challenge for the Colorado State Highway Department lay in obtaining parcels owned by private citizens—mostly a scattered collection of plots inhabited by motels, cabins, and vacation houses. For example, Walter Lawson, a permanent resident of Drake, became upset when he discovered that highway plans would destroy a ditch he built to irrigate a small acreage of pastureland for his cows. When Lawson wrote a letter to Vail about his concern, the unsympathetic highway engineer bluntly responded, "We are not interested in the cattle industry of the State; we are interested in building highways. That is our one and only business." Vail and his highway department kept on their road-building crusade, acquiring properties and removing at least eleven buildings to advance towards construction.[61]

Once highway engineers surveyed the area and secured easements, the next task involved "Clearing and Grubbing" the upcoming transportation corridor to prepare it for grading. Sweat dripped down the brows of construction workers as they removed all debris that would inhibit a smooth motorway, getting rid of old fences and taking away large boulders that stood within the right-of-way. As crews labored, they also cleared away "Scattered Pine, Cedar, and Cottonwood Trees and Small Brush" alongside the Big Thompson River. The indiscriminate removal of streamside vegetation, however, resulted in several altered features for this canyon watercourse that enhanced geo-fluvial processes: the elimination of riverfront plants contributed to increased stream flows as less water would be absorbed by the vegetation; absent riparian flora no longer provided buffer zones to check flood height and velocity, which would have decelerated river currents; and gone was much of the streamside vegetation that anchored the soils, which would have offered channel stability and prevented erosion. Riprap eventually covered these areas as well and inhibited most riverfront plants from growing again. Clearing and grubbing, overall, meant positive steps towards the future highway at the peril of future travelers.[62]

After these obstructions were removed, the construction companies transitioned to the next task of grading the landscape to provide a solid foundation for the paved highway. The initial phase involved “Drilling and Shooting,” or blasting away at the rock and leveling impeding geophysical features. Laborers drilled holes into key intervals on the mountainside and placed dynamite in these tunneled spaces. When workers ignited the nitroglycerin charges, debris flew everywhere with little control. Some jetted towards the ground. Some soared into vacationers’ housing. Some smashed into workers’ bodies, as Earl Gainsforth discovered. Some cascaded down into the Big Thompson River. D.S. Moore, a resident engineer on the project, reported: “During the necessary shooting, some of the material has dropped over the shoulder and into the river. …I have had the contractor clean up the channel [but] …it is very difficult to get the shovel into the river.” Although Moore maintained that “the flow of water will not be in any way impaired by this condition,” the highway engineer ignored the fact that construction debris next to the river, especially when accumulated, concentrated stream flow.[63]

In the secondary “Excavation” phase, construction teams with mechanized bulldozers, shovelers, steamrollers, and dump trucks moved into the thoroughfare to create a firm, level substructure before paving. Unloading gravel and moving dirt with the machinery, workers built large “embankments” to shield the road from the river and enlarged a route two- to three-times wider than the original path. While the road design facilitated more lanes for more vehicles, the groundwork altered the form of the river by constricting it in numerous sections. In several cases, topographical realties within the canyon forced engineers to make “channel changes” to the Big Thompson River. What technocrats like Vail and regional engineer A.B. Collins labeled as “channel improvements” often entailed straightening out natural bends in the stream. Instead of the twisting and turning which functioned to slow down river current, construction workers realigned the river course in some twenty-seven junctures throughout the canyon. By modifying river form—constricting and straightening—highway engineers thus altered river function—increasing its hydraulic power and velocity.[64]

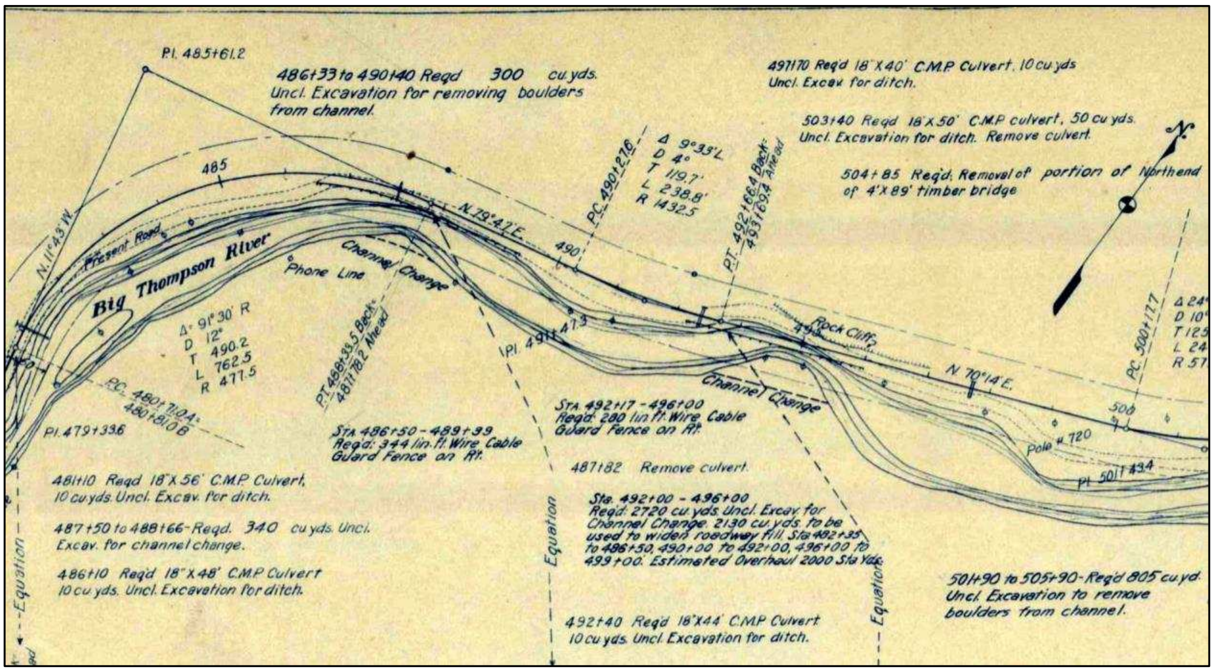
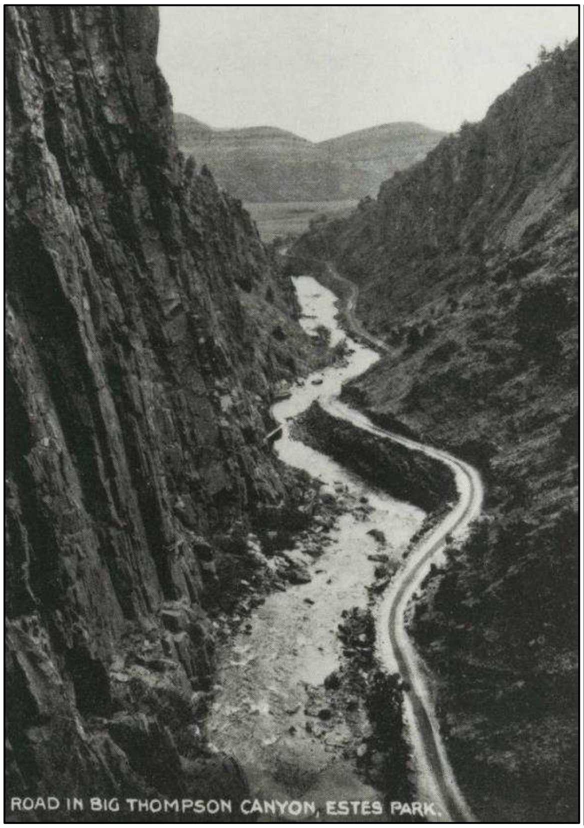
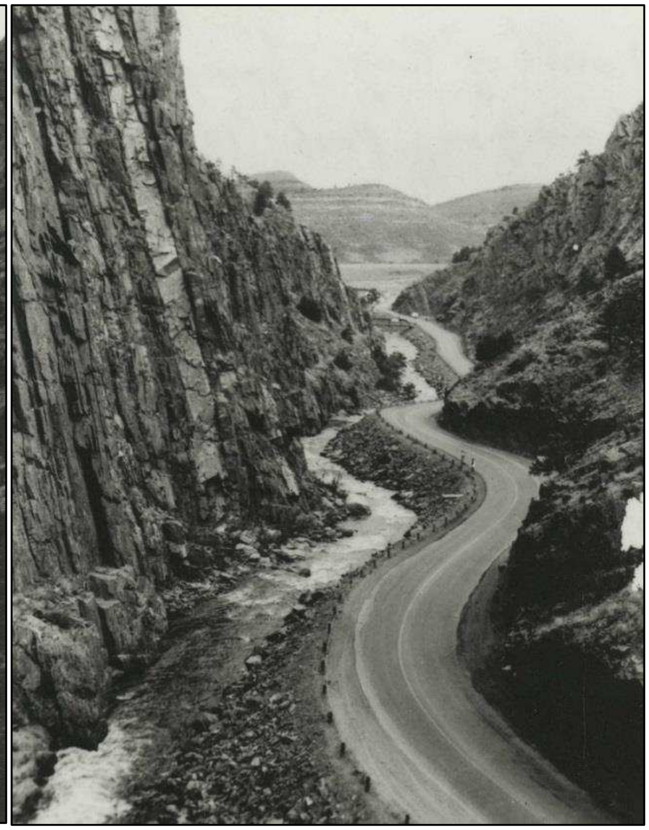


Figure 1.2. 1930s construction plans for U.S. Highway 34 between Estes Park and Drake. Note the “channel change” to Big Thompson River, twice. Courtesy of Colorado Department of Transportation.





Figures 1.3 and 1.4. The Big Thompson Canyon route circa-1910 (*left*) and circa-1940 (*right*) at the Narrows. Note the channel constriction of the Big Thompson River after U.S. Highway 34 was constructed. Courtesy of Fort Collins Museum of Discovery Archives.

The nearer the construction crews inched towards completion, the more frantically they labored to meet engineers' deadlines: installing 8,107 linear feet total of corrugated-metal culvert pipes, pouring 5,453 cubic yards of concrete, reinforcing with 718 tons of steel, erecting six major bridges, and steamrolling some 440,000 square feet of terrain.[65] All these steps were meant to prepare the firm roadbed for the final stage of its supposed technological mastery over nature: "oil surfacing." Hydrocarbons reinforced hydrocarbons as highway workers operated large, gasoline-fueled trucks to apply a sticky "oil" substance manufactured as a by-product during fuel refining, known as asphalt. Standard Oil of Indiana (Amoco) supplied this petroleum derivative—over 2.5 million gallons in 1933 alone—to the Colorado State Highway Department for applications on their expressways. When construction workers sprayed asphalt onto the road surface, it mixed with dirt and gravel, hardening over hours. Oil surfacing delivered a more durable highway for motorist travel, but it also provided a surface which was more impermeable to water infiltration. Instead of a majority of rainfall percolating down into the soil, most rainwater now collected on the pavement. This newly-erected, impervious surfacing contributed to runoff concentration and overland flow, both of which strengthened the hydrological movement of the Big Thompson River. In sum, asphalt paving, while facilitating convenient and dust-free auto tourism, expedited fluvial accumulation and speed.[66]

After nearly seven years, from late-1932 to mid-1938, road builders had finished the modern Big Thompson Canyon route. Despite the fact that Vail and the Colorado State Highway Department had overshot their initial budget (nearly two times more than originally planned) for final cost of $1.3 million, local Coloradans celebrated this engineering accomplishment. “Mr. Vail has helped these migratory Americans to enjoy the wonders of Colorado,” one engineering journal had earlier commended, “first, by his *epochal* work in improving Denver’s mountain parks, and, second, by his direction of the highway improvement program that makes the Silver State more accessible to visitors who travel by automobile.”[67] On Memorial Day weekend of May 1938, Governor Ammons and Vail directed the formal dedication ceremony to “unlock” U.S. Highway 34 at the mouth of the canyon near Loveland. The following day, on May 29, around twenty thousand people gathered in Estes Park for a parade and festivities. Among the string of floats that passed by, Rocky Mountain National Park provided one that depicted the evolution of the tourist, praising the benefits of new automotive travel for the national park. Vail’s work was undeniably epochal. It epitomized the Anthropocene epoch.[68]

Figure 1.5. The 1938 dedication ceremony for the Big Thompson Canyon highway, with Governor Teller Ammons (*second from right with key*) and engineer Charles Vail (*far right*). *Fort Collins Express-Courier*, May 29, 1938. Courtesy of Fort Collins Museum of Discovery Archives.

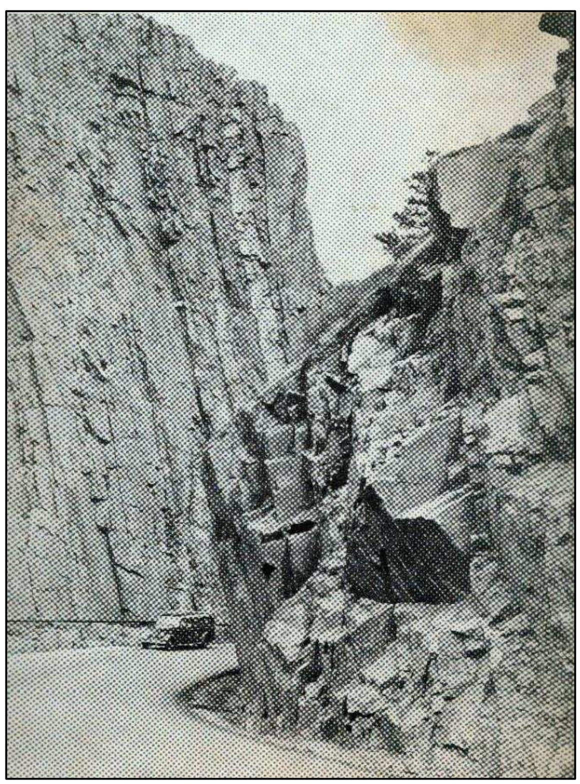


Figure 1.6. One of the first automobiles to travel up the new highway of the Big Thompson Canyon. *Estes Park Trail*, April 22, 1938. Courtesy of Estes Park Museum.

* * *

In hindsight, the canyon bottom—occupied by highway and stream—was shaped by a mixture of geophysical agencies. The Big Thompson River relied on solar heat, water, and gravity to erode its course through the mountains while the Colorado State Highway Department depended upon huge sums of state money, industrial machinery, fossil fuels, and human labor to do much the same. Indeed, construction laborers such as Earl Gainsforth used New Deal monies, Caterpillar machinery, and Rockefeller petroleum in order to evolve into geomorphic agents. But instead of building a road that would complement the topographical and geological realities within the Big Thompson Canyon, Charles Vail and other highway engineers believed in a malleable nature that would conform to human-built infrastructure. In large part, the hydrocarbon energy derived from petroleum—providing the mechanical power for dump trucks, bulldozers, and jackhammers—gave them solid reason to believe in their geomorphic abilities. These technocrats constructed an automobile highway that they thought would provide both smooth transportation for tourists and withstand the forces of nature. They would be right on one count.[69]

Engineers not only altered the geophysical features in a new highway to allow motorists to step on their automobile accelerators, but projects like this also set a foundation—in roads, cars, and oil consumption in an aggregated sense—for the Great Acceleration. In the state of Colorado, the total amount of paved highways increased from 343 miles in 1930, to 3,640 in 1950, to 8,821 by 1970. The total in the United States escalated from 86,515 miles in 1930, to 267,645 in 1950, to 455,915 by 1970.[70] The number of highways constructed worldwide has continued to climb as almost half of all roads by 1990 would be paved.[71] Today, this network of paved roadways has risen to over 11.2 million miles and, if connected end to end, would circle the Earth some 450 times.[72] The global explosion of roadbuilding, a process underwritten by entangled agencies, buttresses the view that humans as geophysical agents was historically contingent upon various nonhuman material forces. Following World War II, tourism businesses profited from the Great Acceleration of roads, cars, and fossil fuels by promoting vacation travel within the Big Thompson Canyon. Their words would prove equally powerful as they attracted more people to visit and reside on the floodplain.

## NOTES

[1] "Formally Open Thompson Road," *Fort Collins Express-Courier*, 29 May 1938, Archives, Museum of Discovery, Fort Collins, CO (hereafter cited as FCMOD); "Governor Adams Will Preside at Big Thompson Opening," *Fort Collins Leader*, 27 May 1938, FCMOD; James H. Pickering, *America's Switzerland: Estes Park and Rocky Mountain National Park, the Growth Years* (Boulder: University Press of Colorado, 2005), 304-06; Kenneth Jessen, "Big Thompson Canyon—Beauty from disaster," *Empire Magazine*, 27 January 1980, 37, Folder 8, Box 1, Records of Wright Water Engineers, Inc., Water Resources Archive, Fort Collins, CO (hereafter WWE Records); "New Highway Thru Spectacular Big Thompson Canon Dedicated," *Denver Post*, 29 May 1938, Newspaper Clippings: Subject- Roads. Colorado, State Highway #16, Denver Public Library, Denver, CO (hereafter cited as DPL).

[2] Jeff Rennicke, *The Rivers of Colorado* (Billings, MT: Falcon Press, 1985), 18-19; Howard Ensign Evans and Mary Alice Evans, *Cache la Poudre: The Natural History of a Rocky Mountain River* (Niwot: University Press of Colorado, 1990), 7-14; Keith Heyer Meldahl, *Rough-Hewn Land: A Geologic Journey from California to the Rocky Mountains* (Los Angeles: University of California Press, 2011), 189-95; Scott A. Elias, *Rocky Mountains* (Washington, D.C.: Smithsonian Institution Press, 2002), 16-22; Richard Cannings, *The Rockies: A Natural History* (Vancouver, BC: Greystone Books, 2005), 38-39.

[3] Roger LeB. Hooke, "Spatial distribution of human geomorphic activity in the United States: comparison with rivers," *Earth Surface Processes and Landforms* 24 (1999): 688.

[4] Bruce H. Wilkinson, "Humans as geological agents: A deep time perspective," *Geology* 33 (March 2005): 161-64; Roger LeB. Hooke, "On the history of humans as geomorphic agents," *Geology* 28 (September 2000): 843-46; P.K. Haff, "Hillslopes, rivers, plows, and trucks: mass transport of the Earth's surface by natural and technological processes," *Earth Surface Processes and Landforms* 35 (August 2010): 1157-66; Ellen Wohl, "Human impacts to mountain streams," *Geomorphology* 79 (2006): 217-48.

[5] Philip Ball, "The earth moves most for humans," *Nature*, 7 March 2005, http://www.nature.com/news/2005/050307/full/news050307-2.html (accessed on 12 March 2016).

[6] The first estimate is for watercourses in absence of land-use changes while the second figure takes into account human disturbances. Roger LeB. Hooke, "On the efficacy of humans as geomorphic agents," *GSA [Geological Society of America] Today* 4 (September 1994): 224-225.

[7] For an excellent summary of these geomorphological findings, see Andrew S. Goudie, *The Human Impact of the Natural Environment: Past, Present, and Future* (New York: Wiley-Blackwell, 2013), 169-212.

[8] For the idea of "hybridity" that informs this work, see Brett L. Walker, *Toxic Archipelago: A History of Industrial Disease in Japan* (Seattle: University of Washington Press,

2010), 16-21; and Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999), 3-41, 203-09.

[9] Christopher W. Wells, *Car Country: An Environmental History* (Seattle: University of Washington Press, 2012), xxii-xxxiii, 103, 125-26, 221-27; Thomas G. Andrews, *Killing for Coal: America's Deadliest Labor War* (Cambridge, MA: Harvard University Press, 2008), 93-96; Jan Zalasiewicz et al., "Stratigraphy of the Anthropocene," *Philosophical Transactions of the Royal Society A* 369 (2011): 1038-39.

[10] For a general view of road-building for economic recovery, see Howard B. Rose, "Start Those Public Works Now!" *Colorado Highways* 9 (May 1930): 3, Shumate Building Library, Colorado Department of Transportation, Denver, CO (hereafter cited as CDOT-Shumate); "Highways and Unemployment," *Colorado Highways* 9 (August 1930): 3, CDOT-Shumate; and Oliver T. Reedy "The 1931 *Highway* Program," *Colorado Highways* 11 (January 1932): 3, CDOT-Shumate. For specific quotes, see "Highway Work *Should Proceed* at Present Pace," *Colorado Highways* 11 (February 1932): 8, CDOT-Shumate; W.R. Smith, "An Inventory of *Road* Traffic," *Colorado Highways* 11 (February 1932): 11, CDOT-Shumate.

[11] For unemployment statistics in the United States during the Depression Era and the creation of FDR's New Deal, see David M. Kennedy, *Freedom From Fear: The American People in Depression and War, 1929-1945* (New York: Oxford University Press, 1999), 163-67, 131-59. For New Deal and nature, see Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 1979), 3-8, 181-82; David P. Billington and Donald C. Jackson, *Big Dams of the New Deal Era: A Confluence of Engineering and Politics* (Norman: University of Oklahoma Press, 2006), 3-12; Paul S. Sutter, *Driven Wild: How the Fight against Automobiles Launched the Modern Wilderness Movement* (Seattle: University of Washington Press, 2002), 48-51; Neil M. Maher, *Nature's New Deal: The Civilian Conservation Corps and the Roots of the American Environmental Movement* (New York: Oxford University Press, 2008), 70-78.

[12] Ira Katznelson, *Fear Itself: The New Deal and the Origins of Our Time* (New York: W.W. Norton & Company, 2013) 230; Kennedy, *Freedom From Fear*, 151-52, 178-79, 181-83; Marion C. Wiley, *The High Road* (Denver: Colorado State Department of Highways, 1976), 24-25; author unknown, *A brief history of the Colorado State Highway Department* (publisher unknown, 1935), 22-24, CDOT-Shumate; U.S. Congress, Transcript of the National Industrial Recovery Act (1933), ourdocuments.gov, http://www.ourdocuments.gov/doc.php?flash=true&doc=66&page =transcript (accessed 20 January 2015). The road-construction provisions in NIRA continued federal aid during that Great Depression started by the Emergency Relief and Construction Act of 1932, which appropriated $120 million. Congress would supplement this road-building fund again by $200 million in 1934 with the Hayden-Cartwright Road Act.

[13] "Governor Adams Names C.D. Vail Highway Engineer," *Colorado Highways* 9 (November 1930): 3, CDOT-Shumate; Wiley, *The High Road*, 24-25; W.M. Williams, "To Chas. D. Vail, Colorado Highway Builder," *Rocky Mountain Contractor* (January 1945): 29-30, Gemmill Library, University of Colorado-Boulder (hereafter CUB-Gemmill); author unknown, *A*

*brief history of the Colorado State Highway Department*, 22-24; Robert Autobee, Teela Labrum, and Deborah Dobson-Brown, *Highways to the Sky: A Context and History of Colorado's Highway System* (Denver: Colorado Department of Transportation, 2002), 6-1-6-6, https://www.codot.gov/programs/environmental/archaeology-and-history/highways-to-the-sky.

[14] W.M. Williams, "Highway Department Makes Steady Progress on Highway Program," *Rocky Mountain Contractor* (14 July 1937): 17-18, CUB-Gemmill; Autobee, Labrum, and Dobson-Brown, *Highways to the Sky*, 6-1-6-6, McComb, *Big Thompson*, 5-6.

[15] Sutter, *Driven Wild*, 108-109.

[16] "Loveland... And Big Thompson Canon's New Highway," *Denver Post*, Vacation Edition, 8 June 1937, Newspaper Clippings: Subject- Roads. Colorado, State Highway #16. Big Thompson, DPL.

[17] "New Road Up Canon Makes Loveland Area Important," *Denver Post*, 7 June 1938, Newspaper Clippings: Subject- Roads. Colorado, State Highway #16. Big Thompson, DPL.

[18] League of Nations, "No. 4354- UNITED STATES OF AMERICA, ARGENTINE REPUBLIC, BOLIVIA, BRAZIL, CHILE, etc. Convention on the Pan-American Highway, adopted by the Inter-American Conference for the Maintenance of Peace. Signed at Buenos Aires, December 23rd, 1936," *Treaties and International Engagements registered with the Secretariat of the League of Nations* 188 (1938): 99-106.

[19] Warren Kelchner, "The Pan American Highway," *Foreign Affairs*, 1 July 1938, https://www.foreignaffairs.com/articles/united-states/1938-07-01/pan-american-highway (accessed on 26 June 2015).

[20] Joseph R. Yogerst, *Long Road South: The Pan-American Highway* (Washington, D.C.: National Geographic Society, 1999), 5.

[21] For calculating mileage, I used the Google Earth program found at https://www.google.com/earth/ (accessed 12 March 2016); for other highway references, see Encyclopædia Britannica Online, s.v. "Pan-American Highway," http://www.britannica.com/topic/Pan-American-Highway (accessed on 12 March 2016).

[22] Lee Casey, "Charles D. Vail, State Highway Czar," *Rocky Mountain News*, 29 February 1943, Newspaper Clippings: Biography- Vail, Charles D., DPL.

[23] "Vail Charged With Unfitness And His Discharge Demanded," *Denver Post*, 14 April 1939, Newspaper Clippings: Biography- Vail, Charles D., DPL.

[24] "Charles D. Vail," *Denver Democrat*, 20 January 1945, Newspaper Clippings: Biography- Vail, Charles D., DPL.

[25] Williams, "To Chas. D. Vail, Colorado Highway Builder," 29-30, CU-B-Gemmill.

[26] Benjamin Weil, "The Rivers Come: Colonial Flood Control and Knowledge Systems in the Indus Basin, 1840s-1930s," *Environment and History* 12 (2006): 3-23; Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002), 2-13, 19-53.

[27] David F. Noble, *America By Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Alfred A. Knopf, 1977), 110-66; Lawrence P. Grayson, "A Brief History of Engineering Education in the United States," *IEEE Transactions of Aerospace and Electronic Systems* 16 (May 1980): 377-78; Amy E. Slaton, *Reinforced Concrete and the Modernization of American Building, 1900-1930* (Baltimore: Johns Hopkins University Press, 2001), 25-28; Ira O. Baker, "Engineering Education in the United States at the End of the Century," *Science* 12 (November 1900): 668; Suhnu Ram Sharma, *Vocational Education and Training: History, Methodology, Issues and Perspective* (New Delhi, IN: Mittal Publications, 1994), 119-20, 133-34.

[28] Peter Lundgreen, "Engineering Education in Europe and the U.S.A., 1750-1930: The Rise to Dominance of School Culture and Engineering Professions," *Annals of Science* 47 (1990): 70-75.

[29] For a scholarly examination on the international dialogue of engineers, see Jessica B. Teisch, *Engineering Nature: Water, Development, and the Global Spread of American Environmental Expertise* (Chapel Hill: University of North Carolina Press, 2011), 1-16, 179-88; for Vail's date since first membership and for foreign members, see American Society of Civil Engineers, *Constitution and List of Members* (New York: American Society of Civil Engineers, 1910), 142, 310-17.

[30] Charles Davis Vail, "Thesis on Tensile Strength of Portland Cement & Lime in Mortar" (Bachelor's thesis, University of Illinois, 1891) Oak Street Archives, University of Illinois, Urbana-Champaign, IL (hereafter cited as UI-OSA).

[31] Wellington's book explains that the primary goal of engineering is "to get the most value for a dollar which nature permits." For quote, see Arthur Mellon Wellington, *The Economic Theory of the Location of Railways* (1877; New York: John Wiley & Sons, 1887), 2. For a detailed analysis of this engineering text, see Richard White, *Railroaded: The Transcontinentals and the Making of Modern America* (New York: W.W. Norton & Company, 2011), 143-44.

[32] "Charles D. Vail, Colorado's Chief of Highway Engineering, Dies at 76," *Rocky Mountain News*, 9 January 1945, Newspaper Clippings: Biography- Vail, Charles D., DPL; "Charles D. Vail, Colorado Highway Engineer, Is Dead," *Denver Post*, 8 January 1945, , Newspaper Clippings: Biography- Vail, Charles D., DPL; "Governor Adams Names C.D. Vail Highway Engineer," 3, CDOT-Shumate.

[33] Charles Davis Vail, "Highway Location in the Foothills of the Rocky Mountains in a Cloudburst Area" (Master's Thesis, University of Illinois, 1936), UI-OSA.

[34] Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West* (New York: Pantheon Books, 1985), 54-57.

[35]Vail, "Highway Location," 1.

[36] Ibid., 21.

[37] For a few "flood menace" references, see Ibid., 7, 35. For quotes, see Ibid., 21, 37.

[38] Vail, "Highway Location," 57.

[39] Paul Hirt, *A Conspiracy of Optimism: Management of the National Forests Since World War Two* (Lincoln: University of Nebraska Press, 1994), xxii-xlviii.

[40] Ibid., 2.

[41] Ibid., 42-50.

[42] In many regards, the highway project fits into the ideology of "high modernism." For high modernism and legible landscapes, see James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998), 1-8, 11-52. See also, James W. Feldman, "The Need for Legible Landscapes: Environmental History and NPS Management at Apostle Islands National Lakeshore," *George Wright Forum* 28 (2011): 148-160.

[43] Thomas Zeller, *Driving Germany: The Landscape of the German Autobahn, 1930-1970*, trans. by Thomas Dunlap (New York: Berghahn Books, 2007), 52-59, 168-72; Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water*, Revised Edition (New York: Penguin Books, 1993), 214-54; Robert A. Caro, *The Power Broker: Robert Moses and the Fall of New York* (New York: Alfred A. Knopf, 1974), 639-88.

[44] Federal Aid Project 9-R-4, "Notice to Contractors," Colorado State Highway Department, 20 July 1936, CDOT Central Files-C-31; Chas. D. Vail, "9-R-4 Memorandum," Colorado State Highway Department, 20 July 1936, CDOT Central Files-C-31; Chas. D. Vail, Letter to J.A. Elliott, 29 August 1933, CDOT Central Files-C-31; Chas. D. Vail, Letter to Clyde Walters, 22 January 1937, CDOT Central Files-C-31. For thoughts on human labor, energy, and machines that influenced my conceptualization, see Thomas G. Andrews, "'Made by Toile'? Tourism, Labor, and the Construction of the Colorado Landscape, 1858-1917," *Journal of American History* 92 (December 2005): 837-63; and Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995), 3-29.

[45] On hydrocarbon history, see Mark Fiege, *The Republic of Nature: An Environmental History of the United States* (Seattle: University of Washington Press, 2012), 362-379; Andrews, *Killing for Coal*, 29-31.

[46] Alfred W. Crosby, *Children of the Sun: A History of Humanity's Unappeasable Appetite for Energy* (New York: W.W. Norton & Company, 2006), 1-44; Steven Vogel, *Prime Mover: A Natural History of Muscle* (New York: W.W. Norton & Company, 2001), 1-29, 152-83.

[47] John Rae and Rudi Volti, *The Engineer in History*, Rev. Edition (New York: Peter Lang Publishing, 2001), 98-105; David P. Billington, *The Innovators: The Engineering Pioneers Who Made America Modern* (New York: John Wiley & Sons, 1996), 23-29; James Kip Finch, *Engineering and Western Civilization* (New York: McGraw-Hill, 1951), 196-97.

[48] Eric C. Orlemann, *Caterpillar Chronicle: The History of the World's Greatest Earthmovers* (Minneapolis, MN: Motorbooks International, 2009), 11-13, 24-25. For a superb examination of mine-excavation technologies, see Timothy J. LeCain, *Mass Destruction: The Men and Giant Mines that Wired America and Scarred the Planet* (New Brunswick, NJ: Rutgers University Press, 2009) 146-59.

[49] For Moore quote, see Project 9-R-1, Construction Progress Report, 24 December 1932, Sheet 2, CDOT Central Files-C-31, emphasis added by author. For other sources, see Federal Aid Project 9-R-3, Construction Progress Report, 1 February 1936, Sheet 1, CDOT Central Files-C-31; Federal Aid Project 9-R-3, Construction Progress Report, 18 April 1936, Sheet 1, CDOT Central Files-C-31; Federal Aid Project 9-R-3, Construction Progress Report, 29 February 1936, Sheet 1, CDOT Central Files-C-31; Federal Aid Project 9-R-3, Construction Progress Report, 2 May 1936, Sheet 1, CDOT Central Files-C-31; Federal Aid Project 9-R-3, Construction Progress Report, 18 January 1936, Sheet 1, CDOT Central Files-C-31; Colorado State Highway Department, "Equipment Rental Rates," 1 May 1938, Folder 10: Equipment Rates, Box 23: T143 51223, Transportation- Colorado Department of Highways, Colorado State Archives, Denver, CO.

[50] Andrew Nikiforuk, *The Energy of Slaves: Oil and the New Servitude* (Vancouver, BC: Greystone Books, 2012), 30-61; H.W. Brands, *American Colossus: The Triumph of Capitalism, 1865-1900* (New York: Doubleday, 2010), 71-76, 86-92; Wells, *Car Country*, 173-185; Alison Fleig Frank, *Oil Empire: Visions of Prosperity in Austrian Galicia* (Cambridge, MA: Harvard University Press, 2005), 1-21.

[51] U.S. Energy Information Administration, "U.S. Field Production of Crude Oil," U.S. Department of Energy, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s= MCRFPUS2&f=A (accessed on 11 July 2015).

[52] Ezra S. Krendel, "Muscle-Generated Power," in *Marks' Standard Handbook for Mechanical Engineers*, 11th edition, eds. Eugene A. Avallone, Theodore Baumeister III, and Ali M. Sadegh (New York: McGraw-Hill Publishers, 2006), 9-4; John S. Page, *Estimator's Equipment Installation Man-Hour Manual*, Third Edition (Houston, TX: Gulf Publishing Company, 1999), 186-87; Keith Haddock, *The Earthmover Encyclopedia* (St. Paul, MN: Motorbooks International, 2002), 23.

[53] Federal Aid Project 9-R, "Statement of Labor and Materials," 23 April 1938, Sheets 1-13, CDOT Central Files-C-31.

[54] "Loveland... And Big Thompson Canon's New Highway," *Denver Post*, Vacation Edition, 8 June 1937, Newspaper Clippings: Subject- Roads. Colorado, State Highway #16. DPL.

[55] Dov Nir, *Man, A Geomorphological Agent: An Introduction to Anthropic Geomorphology* (Boston: D. Reidel Publishing, 1983), 70, 134.

[56] Colorado State Highway Department, Clyde Walters, Letter to Roy J. Randall, 7 November 1936, CDOT Central Files-C-31.

[57] For ideas about an envirotechnical system, see Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône* (Cambridge, MA: Harvard University Press, 2011), 1-27; and Thomas P. Hughes, *Human-Built World: How to Think about Technology and Culture* (Chicago: University of Chicago Press, 2004), 153-173. For dynamic between engineers and rivers, see Jared Orsi, *Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles* (Los Angeles: University of California Press, 2004).

[58] Colorado State Highway Department, "Contract: Federal Aid Project No. 9-R-1," 12 October 1932, CDOT Central Files-C-31; Colorado State Highway Department, "Contract: Federal Aid Project No. 9-R-3," 25 September 1935, CDOT Central Files-C-31; Colorado State Highway Department, "Contract: Federal Aid Project No. 9-R-4," 14 August 1936, CDOT Central Files-C-31; Colorado State Highway Department, "Contract: Federal Aid Project No. 9-R-5," 3 October 1936, Microfilm Roll C-32, Central Files, Headquarters Building, Colorado Department of Transportation, Denver, CO (hereafter cited as CDOT Central Files-C-32); Colorado State Highway Department, "Contract: Federal Aid Project No. 9-R-6," 2 September 1936, CDOT Central Files-C-32; Colorado State Highway Department, "Contract: Federal Aid Project No. 9-R-7," 18 November 1936, Central Files-C-32; U.S Department of Agriculture, Bureau of Public Roads, A.E. Palen, Letter to Chas. D. Vail, 7 December 1932, Central Files-C-31. For an outstanding discussion of public vs. private interests, see Karl Brooks, *Public Power, Private Dams: The Hells Canyon High Dam Controversy* (Seattle: University of Washington Press, 2006), 3-22.

[59] Arthur G. Bruce, *Highway Design and Construction* (Scranton, PA: International Textbook Company, 1934), 535. For a similar example, see Arthur H. Blanchard and Henry D. Drowne, *Text-Book on Highway Engineering* (New York: John Wiley & Sons, 1914), 41-43.

[60] Colorado State Highway Department, Plan and Profile of Proposed Federal Aid Project No. 9-R, Right-of-way map, Sheets 1, 7, 8, Online Transportation Information System, Colorado Department of Transportation, http://dtdapps.coloradodot.info/otis (accessed on 5 January 2015) (hereafter cited as CDOT-OTIS); Colorado State Highway Department, Plan and Profile of Proposed Federal Aid Project No. 9-R-3, Right-of-way map, Sheets 1, 19-21, CDOT-OTIS; Colorado State Highway Department, Plan and Profile of Proposed Federal Aid Project No. 9-R-4, Right-of-way map, Sheet 1 CDOT-OTIS; Colorado State Highway Department, Plan and

Profile of Proposed Federal Aid Project No. 9-R-5, Right-of-way map, Sheets 1, 17, CDOT-OTIS; Gregory Summers, *Consuming Nature: Environmentalism in the Fox River Valley, 1850-1950* (Lawrence: University Press of Kansas, 2006), 83-98.

[61] U.S. Department of Agriculture, Forest Service, Allen S. Peck, Letter to Colorado State Highway Department, 17 September 1936; Colorado State Highway Department, Chas. D. Vail, Letter to A. Walter Lawson, 29 July 1937, CDOT Central Files-C-31; Colorado State Highway Department, Chas. D. Vail, Letter to A.B. Collins, 7 August 1935, CDOT Central Files-C-31.

[62] Federal Aid Project 9-R-1, "Right-of-Way Construction Plans," Sheet 7, CDOT-OTIS; Robert J. Naiman and Henri Decamps, "Ecology of Interfaces: Riparian Zones," *Annual Review of Ecology and Systematics* 28 (1997): 621-58.

[63] Federal Aid Project 9-R-3, Construction Progress Report, [1936?], Sheets 2, CDOT Central Files-C-31; John A. Cross, Letter to Chas. D. Vail, 24 February 1937, CDOT Central Files-C-31; Mont J. Moses, Letter to Colorado State Highway Department, 8 July 1937, CDOT Central Files-C-31; Colorado State Highway Department, Clyde Walters, Letter to Roy J. Randall, 6 January 1936, CDOT Central Files-C-31; Federal Aid Project 9-R-1, Construction Progress Report, 21 January 1933, Sheets 1-2, CDOT Central Files-C-31.

[64] Federal Aid Project 9-R-4, Construction Progress Report, 14 November 1936, Sheet 1, CDOT Central Files-C-31; Colorado State Highway Department, No. 9-R-6, Right-of-way map, Sheets 9-11, CDOT-OTIS; Colorado State Highway Department, No. 9-R-8, Right-of-way map, Sheet 18, CDOT-OTIS; Colorado State Highway Department, No. AW6010, Right-of-way map, Sheets 12-13, CDOT-OTIS. For the environmental impact of roads on the upper South Platte Basin, see Ellen E. Wohl, *Virtual Rivers: Lessons from the Mountain Rivers of the Colorado Front Range* (New Haven, CT: Yale University Press, 2000), 125-37; and Ellen E. Wohl, *Mountain Rivers Revisited* (Washington, D.C.: American Geophysical Union, 2010), 295-327.

[65] Federal Aid Project 9-R, "Statement of Labor and Materials," 23 April 1938, Sheets 1-13, CDOT Central Files-C-31.

[66] Federal Aid Project 9-R-3, "Explanation of Overruns and Underruns," 1935, CDOT Central Files-C-31; Federal Aid Project 9-R-3-4-5-6-7-8, "Colorado State Highway Department-Engineer's Detailed Estimate," 8 April 1937, CDOT Central Files-C-31; Standard Oil Company of Indiana, "Rocky Mountain Road Development: A Credit to Rocky Mountain Official and Engineers and Standard Asphalt," *Rocky Mountain Contractor* (14 July 1937): 10-11, Gemmill Library, University of Colorado-Boulder; Acting Purchasing Agent, Letter to Chas. D. Vail, 1 June 1933, Folder: Oil Misc. 1929-1933, Box 35: T155 51235, Transportation- Colorado Department of Highways, Colorado State Archives, Denver, CO; Wiley, *The High Road*, 24; Fiege, *The Republic of Nature*, 367.

[67] Nelson Sutro Greensfelder and Harry Roberts, Jr., eds., "Charles Davis Vail – a Biography," *Explosives Engineer* 13 (November 1935): 321-25, University of Michigan Libraries. Emphasis added by author.

[68] "New Big Thompson Highway Nearing Completion," 3 June 1937, Binder: 1937-1938, Box 19213: Press Releases, Transportation- Colorado Department of Highways, Colorado State Archives, Denver, CO; "Formally Open Thompson Road," *Fort Collins Express-Courier*, 29 May 1938, Archives, Museum of Discovery, Fort Collins, CO; "Governor Adams Will Preside at Big Thompson Opening," *Fort Collins Leader*, 27 May 1938, FCMOD; Pickering, *America's Switzerland*, 304-306; Kenneth Jessen, "Big Thompson Canyon—Beauty from disaster," *Empire Magazine*, 27 January 1980, 37, Folder 8, Box 1, WWE Records; "New Highway Thru Spectacular Big Thompson Canon Dedicated," *Denver Post*, 29 May 1938, Newspaper Clippings: Subject- Roads. Colorado, State Highway #16, DPL. While some newspaper articles stated that the final construction cost for U.S. 34 was $1.8 million, a press release from the Colorado State Highway Department clarified the figure was actually $1.3 million.

[69] Scott, *Seeing Like a State*, 1-8. For anthropological theory on "vulnerability," see Anthony Oliver-Smith and Susanna M. Hoffman, eds., *The Angry Earth: Disaster in Anthropological Perspective* (New York: Routledge, 1999), 89-112, 192-212.

[70] U.S. Department of Commerce, Bureau of Domestic and Foreign Commerce, *Statistical Abstract of the United States, 1930* (Washington, D.C.: Government Printing Office, 1930), 378; U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics, 1950* (Washington, D.C.: Government Printing Office, 1952), 116; U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics, 1970* (Washington, D.C.: Government Printing Office, 1970), 158.

[71] In 1990, forty-seven percent of the world's roads were paved for all countries with data available. For statistics, see United Nations, "Roads, paved (% of total roads)," UN data, http://data.un.org/Data.aspx?d=WDI&f=Indicator_Code%3AIS.ROD.PAVE.ZS#WDI (accessed on 1 April 2015).

[72] For the numbers of paved highway for each country, see The World Factbook, "Country Comparison to the World: Roadways," U.S. Central Intelligence Agency, https://www.cia.gov/library/publications/the-world-factbook/fields/2085.html (accessed on 14 March 2016). The circumference of the earth is 24,901 miles while, by the year 2016, the total figure of paved roads worldwide is some 11,206,870 miles.

# CHAPTER TWO

## ACCELERATING TOURISM, ACCELERATING SUBURBANIZATION

During the 1950s and 1960s, beginning June 15 and ending September 10, the Rocky Mountain Motor Company provided sightseeing excursions to travelers entering Denver by auto, rail, or plane. Upon arrival, a nuclear family of four could pay the company ninety-six dollars total for a "scenic circle tour" through Rocky Mountain National Park. The two-day, "all-expense" holiday "include[d] bus fare, three meals, and one [night] lodging." Vacationers, stepping aboard one of the many Gray Line buses, departed promptly at 9 a.m. on the first day and started northward. Reaching Loveland, the half-red, half-gray, touring buses turned west.[1] As these large vehicles headed into the Big Thompson Canyon, passengers likely took notice. "This is one of the most memorable features of your whole visit to the Park," one tourist booklet declared. "For sixteen miles the road lies between rugged rock walls that sometimes tower a good 1,200 feet above you. Beside you, most of the way, the river is a raging, foaming torrent…" From this spectacle, the travel guide reaffirmed what many tourists probably thought: "Here is rare mountain beauty in all its glory."[2] The outing, though, was far from over—visitors still had a luncheon at the Estes Park Chalet, a motor trip through the national park, and a hotel stay with dinner at Grand Lake Lodge. On the second day, leaving at 8:15 a.m., the return to Denver was rounded out with a journey southward over Berthoud Pass and a brief stop at the old mining town of Idaho Springs, before coming back to the capital city by the noon hour.[3]

While the Rocky Mountain Motor Company certainly offered pleasant trips during the post-World War II years, the "scenic circle tour" concealed more about the complex ecosystems the buses passed than it actually revealed. Hidden from tourists' view, most notably, was the constructed nature of the Big Thompson Canyon and its rising vulnerability to a disastrous flood. The "raging, foaming torrent" of the Big Thompson River owed just as much to the modern highway and infringing summer homes as to the "rugged canyon walls" themselves. In place of this reality, however, canyon-goers often saw an attractive, pristine landscape primed for frequent visitation through tourist-centered advertisements. As sightseers, retirees, and outdoor-lovers moved within the mountain gorge, promotional literature acted as a "cultural filter," shaping the ways in which these people viewed and engaged with their surroundings. Vacation entities, too, promoted images of a benign environment through their advertising rhetoric. By highlighting natural wonders and downplaying natural hazards, boosters inadvertently colored human perceptions about the Big Thompson River.[4]

Another aspect of the "scenic circle tour" was not easily displayed to visitors: idealized versions of the Big Thompson Canyon, Estes Park, and Rocky Mountain National Park (RMNP) worked alongside bigger historical forces. Larger and larger numbers of people each year, seeking recreation and recuperation, traveled by or lived near the Big Thompson River. The influx of vacationers restructured the area into what historian Lizabeth Cohen has called a "landscape of mass consumption." The rising tide of cars—in tandem with the swelling number of vacation houses, retirement homes, overnight motels, and tourist shops—modified both the bank accounts of mountain economies and the banks of a mountain river. But the development of suburban living, mass vacations, and a consumer society was not isolated to the Big Thompson Canyon, the state of Colorado, or even the United States. These local transformations linked with larger developments following World War II. The same 1967 Rocky Mountain Motor Company brochure that offered Gray Line bus tours from Denver into the Rockies also advertised Gray Line vacation trips to other worldly destinations: Bahamas, Canada, Mexico, Tahiti, Australia, and Hong Kong. Like reaching all these vacation spots, the postwar development of the Big Thompson Canyon as a tourist and suburban haven relied on cheap and abundant fossil fuels. With hydrocarbons galore, and with the cultural values that they fostered, the mountain gorge epitomized some of the global changes driving the Great Acceleration of the Anthropocene.[5]

*Promotions and Perceptions*

Imagine picking up a 1956 Estes Park Chamber of Commerce brochure. It poses the question: "Why Vacation in Many Places When Everything for the Perfect Vacation is Here?" Marketed to readers who want escape from an urban-industrial world, the rhetorical prose aids in conjuring images of a bucolic nature by offering an enumeration of major tourist selling points: "SCENERY… unlimited in every direction," "CLIMATE…days pleasantly warm, evenings refreshing cool," and most importantly, "ACCESSIBLITY…over broad, paved, high-gear roads." Even today, one feels awestruck by this seemingly unspoiled Colorado "vacationland," just as so many Americans during the postwar years did. One cannot resist the urge to travel on U.S. Highway 34 to this high-country resort, for "ESTES PARK…has everything!"[6]

From the mid-1940s through the 1970s, vacation boosters—like in the pamphlet mentioned above—fed into notions of consumerism that transformed Americans' mental images of the landscape. The Estes Park Chamber of Commerce and other tourism organizations spent long hours and thousands of dollars to produce the ideal promotional formula that would attract more travelers, more trips, and ultimately, more money. The town of Estes Park, its neighboring hinterlands, and the entire Colorado high country became a commercial product over time. As environmental historian William Philpott has observed, resort towns like Aspen, Estes Park, and Vail were "manufactured, packaged, branded, and marketed like so many consumer goods." For that reason, vacation advertisers did not represent the holistic character of the Big Thompson Canyon and its dynamic river that, from time to time, flooded. These publicists, alternatively, mirrored back the selected portions of mountain vistas that leisure-seekers themselves wanted to see; and consequently, they reinforced environmental preconceptions of the Big Thompson River for visitors, residents, and propagandists alike.[7]

Many tourist entities praised the advancements in transportation mobility that offered travelers safe and comfortable nature-viewing experiences. A 1971 Colorado vacationers' magazine, published by the American Automobile Association, urged visitors to "Speed along smooth highways to such unique and picturesque places as…Drake and Glen Haven [in the Big Thompson Canyon], where the Old West still lives."[8] A circa-1950s traveler's guide touted the grandeur and ease of travel to Estes Park and RMNP:

> Either coming or leaving, you should arrange to take the trip through the beautiful Big Thompson Canyon, which is one of the most unique and picturesque of all canyon drives. A new, oiled, wide highway runs along the banks of the roaring mountain stream, bounded in both sides by sheer walls of colorful rocks. U.S. 34 is the Big Thompson Canyon route into Estes Park.[9]

By comparing the constructed road to landscapes features, some tourist accounts more or less naturalized U.S. Highway 34. "The Big Thompson Canyon route, via Loveland, traverses the celebrated Box Canyon in the Roosevelt National Forest, towering hundreds of feet on either side of the winding Big Thompson River," a tourist guidebook acclaimed. "Twisting and turning as it climbs the gorgeous canyon, the road suddenly emerges into the northeast section of Estes Park."[10] The historian David Louter developed the phrase, "windshield wilderness," for the physical integration of aesthetic settings and transportation infrastructure in national parks.[11] Tourism literature, from a psychological standpoint, functioned much the same for the Big Thompson Canyon.

Aside from accessibility to nature, tourist organizations glamorized the Rocky Mountain-region weather and climate to entice vacationers and embellish the experience. A 1964 Estes Park magazine, for instance, proclaimed that the area had "SUNSHINE – All year round" and an "invigorating climate."[12] The most striking example comes from an Estes Park Chamber of Commerce pamphlet, entitled *How's the Weather in Estes Park?*, utilized from 1959 until at least 1966. Ruby Marden, wife of Chamber president Michael Marden, recorded the temperature and precipitation from September 1957 through August 1958 in order to characterize the weather of Estes Park and, by extension, the Big Thompson Canyon for its proximity. Besides registering meteorological conditions, Marden provided general observations about the weather each day, which the brochure guaranteed were "her natural expression, without expectation of publication." In analyzing her commentary for all 365 days, Marden logged 207 "beautiful!" mentions, ten "lovely" remarks, and a single note of "another gorgeous one." In all, positive comments outweighed negative ones at a rate of fifty-four to one. The tourist pamphlet, acting as a prism through which to view the environment, concluded that the area features an "easy climate to get along with and seldom really disagreeable."[13]

Boosters funded these types of messages to be spread throughout the country. In March 1950, Michael Marden hired the marketing firm, W.W. MacGruder, Inc., to promote the region as the "ideal vacation land" to a broader public. Marden paid the business $8,500 to place advertisements in national publications such as *LIFE Magazine* and in "Eastern and Mid-Western…metropolitan newspapers…with their mammoth circulations" like the *Detroit News* and *New York Journal*.[14] While the Dunshee Advertising Agency of Denver eventually took over as chief promotional representative, the Estes Park Chamber of Commerce increasingly committed its finances to almost-unceasing publicity for its resort community. In June 1960, advertising costs alone accounted for $10,000 and comprised over one-quarter of the Chamber's annual budget.[15] Only four months later, members of the Estes Park Chamber of Commerce moved to raise yearly advertising funds to $18,000; and five years later, in 1965, they enlarged the promotional budget to $35,000.[16] The Chamber's marketing dollars, however, were only a fraction of the sums paid for consumer ads during the Great Acceleration. In the United States, advertisement spending rose from $5.7 billion in 1950, to $15.2 billion in 1965, to $27.9 billion by 1975.[17] Around the world, promotional expenditure also skyrocketed from $6.7 billion in 1950, to $22.2 billion in 1965, to $47.4 billion by 1975.[18] During the Anthropocene, advertising companies facilitated consumer demand not only within the Big Thompson Canyon, but across much of the Earth.

For these tourist organizations, the Colorado landscape in general and the Big Thompson Canyon in particular were consumer products. At the 1958 Colorado State Chamber of Commerce annual conference, for example, former U.S. Senator and ex-Governor Edwin C. Johnson gave the keynote address and reiterated these views. In his speech, Johnson compared the state "to a large department store; and its natural features, which attract tourists, as its stock of goods." Extending the analogy, he stated that "the chambers of commerce, tourist bureaus, and others advertising Colorado were the clerks or salesmen in that store."[19] Consistent with Johnson's recommendation, local vacation entities retailed their goods. The Estes Park Chamber of Commerce utilized various promotional channels: "newspapers, brochures, highway signs, magazines, and photographs." By October 1960, the Chamber reported that "over one thousand news releases will have been sent out to newspapers, TV stations, and radio outlets." In addition, "About 80,000 pieces of literature, [*sic*] and printed manner were distributed through one media or another." The Chamber wanted to maintain a "saturation policy" of advertising materials that placed value on—commodified even—the aesthetic and recreational settings of the Colorado high country.[20]


Figure 2.1. A circa-1970s advertising billboard erected by the Loveland Chamber of Commerce. Photo by Kim Ziebell, *Loveland Daily Reporter-Herald*, August 7-8, 1976. Used with permission.

Advertising fashioned the Big Thompson Canyon into an irresistible tourist commodity. A 1940s magazine, *Cool Colorado: Vacation Wonderland!*, identified selling points throughout the Centennial State for recreationists, leisure-seekers, and the like; the landscape between Loveland and Estes Park, Colorado, offered one such place. “The Big Thompson Canyon offers you,” the publication boasted, “All types of accommodations,” “Prices to suit every purse,” “World’s best climate,” “Beautiful scenery and wild life,” “Fishing and pack trips,” and even “Golf and Tennis.” Large, black-and-white pictures of cottages, fishermen, horseback riders, and motorists—all next to the Big Thompson River—accompanied the message: “Loveland---Hub to Northern Colorado Playgrounds---On U.S. Highway 34” through the “Scenic Big Thompson Canyon to ESTES…Rocky Mountain National Park.” The one-page spread reckoned, “Come and stay—a day—a week—or a month.”[21] Fueling part of the cultural expectations behind the Great

Acceleration, these idealized versions of the Big Thompson Canyon became products ready for tourists to consume.

The commercialized bombardment of vacationing messages changed how people thought of the canyon floodplain. Marie and Emery Carter, flatlanders from Illinois who visited the gorge every year since the 1960s, stated that "a new love entered their lives, the Big Thompson Canyon of Colorado."[22] Seeing pure vacation landscapes turned problematic, though, as it enabled a false sense of security.[23] For example, in a 1977 psychological study, a behavioral scientist at the University of Colorado-Boulder administered interviews with both vacationers and residents of the Big Thompson Canyon. One discovery was that some people "perceived no danger from a flash flood warning."[24] Though only anecdotal evidence exists, tourism-anchored perceptions—facilitated by promotional literature—possibly contributed this mindset. A friend of Betty and Vern Maciejewski, owners of the S.S. Rapids Motel in Waltonia since 1972, remembered that "we talked once about the flood potential, but they said there was no worry."[25] Lenore and Paul Griffith, retirees who moved into the canyon in 1966, recalled not once thinking about torrents despite their regularity for the Big Thompson River. When guests asked them about high water, they responded, "Oh, no, it never floods here."[26] And yet these psychological transformations often went hand-in-hand with physical alterations to the Big Thompson Canyon environment as more people entered their cars and turned their ignition keys.

### *Cars and Consumers*

In 1960, locals from Estes Park, Loveland, Greeley, and the Big Thompson Canyon established the Colorado U.S. 34 Association in order to realize two goals for the expressway that made up its namesake. Louis Pettyjohn, president of the newly-formed coalition and a full-time resident of Estes Park, outlined their objectives. Foremost, members desired "to increase the amount of traffic on the highway," mostly because of the economic benefits that came with more travelers. And secondly, in relation to the first purpose, affiliates wanted to eventually fashion a "national association" out of the local organization by rallying political and financial support from "cities and towns along U.S. 34 all the way east to Chicago, where the highway originates."[27] In all, the Colorado U.S. 34 Association sought to further cultivate the automobile lifestyle and culture that had in part spurred on the post-World War II Great Acceleration.

In less than a decade, their two goals were realized. The organization dropped its Colorado label in 1962 and redefined itself solely as the National U.S. 34 Association, joining its neighboring eastern states in promoting auto tourism. The group worked with various entities in Nebraska, Iowa, and Illinois at renaming motorway segments along the route so that all these states featured the U.S. Highway 34 designation on road maps and signage.[28] While the absolute distance of highway itself remained the same length, the thoroughfare shrunk in the minds of potential vacationers as a single highway—as illustrated in the brochure below—led the entire way to Estes Park and Rocky Mountain National Park.[29] Transportation flows accelerated over time along U.S. Highway 34. Within ten years of the association's founding, automobile traffic had quadrupled within the Big Thompson Canyon, and annual visitation to RMNP had doubled.[30]

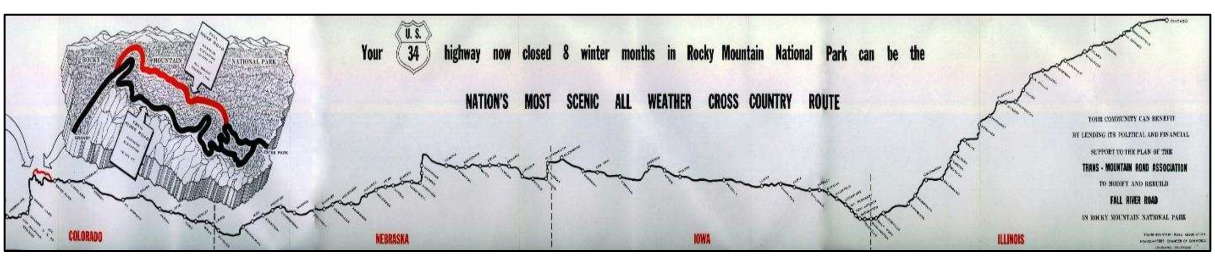



Figure 2.2. A National U.S. 34 Association brochure featuring the highway from Chicago, Illinois, all the way to Rocky Mountain National Park, Colorado. Courtesy of National Archives and Records Administration, Rocky Mountain Region.

But by 1970, it seems as though the U.S. 34 Association was *too* good—or more like *too* successful—at meeting its two objectives because road infrastructure could not keep up. In that year, the organization requested a "route study from Loveland to Estes Park" from the Colorado Highway Commission in order to determine areas for additional capacity on the Big Thompson Canyon route. "The present highway," forecasted a member who was worried about the tourist turnpike's future, "will be completely inadequate to carry the volume of traffic."[31] Still, the U.S. 34 Association was not totally responsible for its own success. For each time more travelers jumped in their vehicles for leisurely escapes to Estes Park and RMNP, they still participated in a wider consumer society that took its fullest shape in the postwar years. Fossil fuels burned at a more frantic pace as greater numbers of automobile engines—devouring gasoline and discharging carbon dioxide—propelled tourists to their destinations. Souvenir shops and other amenities also catered to vacationers' on-the-go demands as they enjoyed the scenic and recreational qualities of the Big Thompson Canyon. While travelers consumed the aesthetic and material wealth that surrounded them, auto tourism shaped both the local hydrology of the Big Thompson River and the global climatology indicative of the Anthropocene.[32]

As the U.S. 34 Association worked to boost transportation volume, and as various tourist entities sang the praises of Estes Park and Rocky Mountain National Park from pamphlets, radio advertisements, and interstate billboards, motorist travel steadily increased within the Big Thompson Canyon. It was likely that a few hundred vehicles per day traveling along the route during the busy summer season of the early 1930s (before the modern highway) escalated into a few thousand following World War II. By the early 1970s, 8,326 automobiles, on average, cruised up and down the 25-mile stretch of U.S. 34 each day during the peak months of June through September. These numbers paralleled the annual rise in the number of recreational visitors to RMNP, many of whom utilized the canyon highway as their chief access point. Park attendance, with almost all individuals entering by car, grew from 255,874 people in 1930, to 1,275,160 in 1950, to 2,357,900 by 1970. In brief, the explosion of vehicles traveling along the Big Thompson River serves as a microcosm for the Great Acceleration in automobility.[33]

The Big Thompson Canyon funneled a varied sort of people into the mountains from places near and far. A 1956 study about Colorado tourism, conducted by a business professor at the University of Colorado-Boulder, has shed some light on this vacationing population. One of the findings was that most people who visited Colorado came from middle- to upper-class backgrounds. In 1953, for example, the median household income in the United States stood at $3,516. However, the average wages for American families who went on vacation that same year totaled $4,135 while the median earnings those who did not go on trips amounted to $2,880. Another discovery was that most persons who traveled to Estes Park and Rocky Mountain National Park, besides those who already lived along the eastern foothills of northern Colorado, hailed from Midwestern and Great Plains states. In descending order based on the sheer numbers, Illinois, Texas, Kansas, Iowa, Nebraska, and Oklahoma had brought in the largest proportions of visitors. According to surveys, these tourists cited "sightseeing" and "mountains" as some of the biggest reasons for coming to Colorado. From farmers to factory workers to financiers, they engaged in diverse occupational experiences but carried one thing in common. The industrial, fossil fuel-based economy that had allowed them to travel to such vacation spots was the same one that produced the Anthropocene: over ninety percent of all people who visited Colorado in 1955 journeyed by car, and each average trip distance equated to more than 2,500 miles.[34]

Businesses and organizations—the U.S. 34 Association included—made diligent efforts in adjusting the landscape of the Big Thompson Canyon to accommodate the "drive-in culture" of fast speeds, quick stops, and full tanks.[35] The Big Thompson Canyon Association (BTCA), which was formally established in 1940 with the task of tourism development, nurtured a reputation for "good fishing," beautiful scenery," and "oiled highways" within its share of the Colorado high country. In 1961, the BTCA convinced the Colorado Department of Highways (formerly the Colorado State Highway Department) to add "three sections" of passing lanes "at strategic points in the canyon" in order to "to relieve slow-moving lines of traffic." The BTCA, moreover, assisted in crafting "scenic turn-outs" at regular intervals on U.S. 34, with several that featured picnic areas and public restrooms with "tables and bar-b-que pits" for wayside breaks.[36] "With at least eight filling stations to service cars," such as the Dam Store located at the mouth of the canyon or the Big Thompson Trading Post near Drake, roadside establishments safeguarded against tourists' fuel-gauges hitting empty and rounded out the "drive-in culture" trifecta.[37]


Figure 2.3. One of eight service stations for people and automobiles in the Big Thompson Canyon, 1973. Courtesy of Fort Collins Museum of Discovery Archives.

A journey between Loveland and Estes Park, which once took a couple days to a week before the onset of the Anthropocene, could now be spanned in a matter of an hour during the Great Acceleration. By "annihilating space" via transportation technologies, as historian William Cronon has called the phenomenon, motorists experienced a different, ostensibly more secure, trip through the canyon river environment.[38] In part, the brevity of the U.S. 34 excursion allowed many vacationers ample time to stop for token souvenirs. A 1964 address directory, for instance, indicated that twenty tourist shops dotted the Big Thompson Canyon: the Narrows Gift Shop and Young's Cement Pottery & Fruit Market near Cedar Cove; the General Store, Riverbend Store, and Munson's Gifts around Drake; the Pine Knot Woodwork Shop and Red Bell Antique Shop close to Glen Comfort; Fry Turfing Gifts and Anderson's Store near Loveland Heights; and finally, Calico Kate's Gift Shop and Rodgers' Art Shop in Glen Haven on Devil's Gulch Road (a spur route off U.S 34).[39] As tourists headed up the mountain gorge, this assemblage of merchants offered a diverse selection of consumer goods—one advertised "Indian Arts and Crafts;" another marketed "China, Glass, and Collectibles;" and still another publicized "Groceries, Gifts, and Fishing Supplies."[40]

Aside from tourist shops, vacationers interested in outdoor recreation could stop along U.S. 34 and obtain another souvenir product right out of the Big Thompson River. Indeed, part of the draw in taking the Big Thompson route for some people became the opportunity to wet a fly-line and hook a trophy-sized trout. In 1940, the BTCA developed a "put-and-take" trout stocking operation a few miles northwest of Drake "to help improve fishing" within the canyon.[41] "We plan to turn out thousands of legal-size trout into the [Big] Thompson and North Fork every year," remarked Max Denter, president of the BTCA. "This program will keep the stream stocked from year to year and bring it back as one of the best fishing streams in the state."[42] The

BTCA worked in conjunction with local chapters of the Izaak Walton League of America, a national sporting club, and the Colorado State Game and Fish Department to develop a hatchery system for this watershed section. The BTCA raised pond-full after pond-full of non-native rainbow trout, growing from miniscule fingerlings to ten-inch juveniles, and planted them within the canyon stream for anglers. Through the fish-stocking program, the Big Thompson River received over twenty thousand rainbows in 1940 and about thirty-two thousand rainbows only a year later.[43] This mass production of trout continued well into the 1970s—a constant supply of fish supported a more constant supply of recreational tourists.[44]

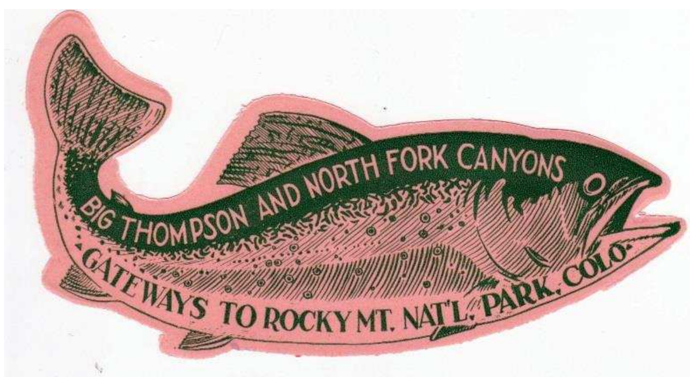



Figure 2.4. A circa-1940s rainbow trout bumper sticker meant to attract anglers in particular and tourists in general to the Big Thompson Canyon and Rocky Mountain National Park. Artistry by Robert Easterday. Courtesy of Big Thompson Canyon Association.

For either recreation or relaxation (or work), the Great Acceleration in automobility to a large degree hinged upon a greater utilization of fossil fuels and on ideological commitments to consumption. These leisure practices often linked with Cold War tensions during the so-called "Age of Oil."[45] In 1955, a triangle of travel between the Lowry Air Force Base near Denver, the trout streams of Fraser, and his grandson's summer camp at Estes Park offered U.S. President Dwight Eisenhower a temporary escape from geopolitical struggles and nuclear anxieties.[46] New automobiles, full gas tanks, and tourist getaways were also outward signs of national affluence and material superiority for both the United States and the Soviet Union. Either nation could parade these well-fueled symbols of prosperity around as physical evidence of winning not the space race but the “consumer race,” offsetting not the missile gap but the “commodity gap.”[47] As a case in point, the American and Soviet consumption of gasoline fuel for personal travel alone about doubled within ten years or less: in the United States, a total of 49 billion gallons in 1965 escalated to 76 billion gallons by 1975; in the Soviet Union, a total of 413 million gallons in 1970 expanded to 1.3 billion gallons by 1975.[48] One could have only accessed distant vacation spots in mountainous regions over the Great Acceleration with hydrocarbon-powered machines. Whether it was Ike with Estes Park in the Rockies, or say, Soviet Premier Joseph Stalin at Sochi in the Caucasus Mountains, resort towns like these two embodied the complex intersection of fossil fuels, automobiles, and tourism.[49]

Increasing motorist travel to and from Estes Park or Rocky Mountain National Park, in many ways, paralleled ever-expanding vehicular traffic across the globe. These automotive proclivities may have assisted in altering atmospheric conditions, in elevating the frequency of severe flooding, and in worsening the magnitude of the 1976 deluge. For instance, contemporary scientific understandings support a causal relationship between auto emissions and changing climate. The typical automobile, according to recent studies, emits approximately one pound of carbon dioxide ($CO_2$) per mile driven. As vehicular travel increased on U.S. Highway 34—emitting $CO_2$ as engines churned—so, too, did the general rise in global atmospheric carbon dioxide that produces a warming atmosphere. Each summer alone during the 1970s, cars, trucks, and motorcycles within the Big Thompson Canyon discharged some 24 million pounds of $CO_2$ into the air. Every year during the same decade, the tailpipes of transportation vehicles around the world released around 880 billion pounds of carbon dioxide. From 1958 to 1976, due in large part to mounting automobile usage, planetary $CO_2$ levels rose from 315 to 333 parts per million.[50]

Small atmospheric changes on the planet—trace upturns in the amount of carbon dioxide—led to big environmental consequences. The Big Thompson Canyon, along with much of the Earth, has heated up over the Great Acceleration. Located not even two miles from the mouth of the canyon, a national weather station recorded a local upsurge in yearly average temperatures—from 47.5° Fahrenheit (F) in 1931, to 47.9° F in 1950, to 48.5° F in 1976, (continuing to 50.0° F in 2010)—which roughly match regional climate trends for Colorado's Front Range.[51] The planet's surface mirrored this propensity with mean annual temperatures rising nearly one degree Fahrenheit total over the twentieth century (and only ten years later, in 2010, about one-half degree Fahrenheit more).[52] Utilizing scientific data on human-induced climate change and precipitation patterns, even modest temperature increases across the globe expand the likelihood and intensity of torrential downpours, many of which produce floods.[53] Heavy rainfall events, while they vary from region to region, generally increase in severity and number because a warmer atmosphere possesses the overall potential to carry more moisture, and hence, to dump more water.[54]

Other factors, indeed, have affected the rising numbers of floods recorded across the world—namely, expanding human infrastructure in susceptible areas and better observational tools.[55] Such complex phenomenon often renders a speculative position based on probabilities. Still, these circumstances do not mean that peer-reviewed science cannot tell us anything about the relationship between global warming and flooding. Climatological and hydrological research, for instance, has shown that the 1976 Big Thompson Flood was consistent with current evidence about human-induced climate change. In 2002, two studies published in the high-profile journal, *Nature*, observed an intensification of the global water cycle from 1950 onwards, which often leads to a profusion of extreme rain events.[56] Over the last decade or so, multiple works also detected climate-related increases in heavy precipitation for the North American continent at the middle latitudes, which encompass northern Colorado, during the second half of the twentieth century.[57] Finally, when analyzing data since 1950 for rivers in the western United States, including Colorado, one 2008 study in the prominent journal, *Science*, concluded that sixty percent of climate-related hydrological changes were human-caused.[58] Although it is unlikely—or near impossible—to know with exact certainty whether or not anthropogenic global warming influenced one particular flood or another, enough pieces of evidence exist to make a reasonable postulation. That is, automobile emissions from increasing vehicular travel around the world may have been a contributing factor in the sheer destructive nature of the 1976 flood. In this sense, perhaps more than any other, the rising number of cars on U.S. 34 can be representative of the Earth-system changes in the Anthropocene.

### *Suburbs and Scenery*

After World War II, the Mortons—who consisted of Theodosia, Charles Edward, and their four children—were searching for an ideal place to spend their summer excursions. In 1950, “Ted” and “Ed” decided to leave home in Houston, Texas, for a month-long holiday with their kids in the Big Thompson Canyon. Renting a cabin within the gorge, the Mortons had thoroughly enjoyed the location where all could easily “hike together, cook-out and explore [Rocky Mountain National] Park.” The Big Thompson Canyon, in fact, became so endearing to the Mortons that they designated it as *the* place for subsequent family vacations. Seventeen years later, after visiting annually, the Mortons “fulfilled a long-standing dream” once Ed retired with a large pension from his industrial position at the Sheffield Steel Company. In 1967, Ted and Ed bought a summer home within the Big Thompson Canyon. Located in Glen Comfort, the "big frame house" faced the Big Thompson River on the north side of U.S. 34, and it became the Mortons' retirement villa for six months out of the year. One of their children remembered "jogging with Daddy [Ed] down the canyon highway, as he waved a snappy salute to neighbors we passed."[59]

When Ted and Ed arrived each May at their address of 2369 Big Thompson Road, the couple definitely noticed that they had plenty of neighbors. For the Mortons were only two individuals of many during the postwar years who settled into mountain retreats within the Big Thompson Canyon: Mildred and Pat Lafferty landed at Loveland Heights in 1945; Juanita and George Ashby relocated to Waltonia in 1953; Ferne and Bob Newlin came to Drake in 1968; and Debbie and Don Karstens lived near the Narrows since 1974, just to name a few.[60] Although people trickled into the gorge during the first half of the twentieth century and earlier, the vast majority of human occupation, in reality, flowed into the canyon between 1940 and 1975.[61] With a high-speed expressway installed in the canyon, and with an ensemble of tourist stores like an outdoor shopping center, only a single element remained to complete historian Lizabeth Cohen's notion of a "landscape of mass consumption." That one missing component—initiated by the Mortons and other canyon inhabitants—was suburbia.[62]

The Big Thompson Canyon was certainly not "suburban" in the traditional sense—no planned developments of monotonous single-family houses on the urban fringe. Lying beyond the suburban periphery, the canyon's "ex-urban" growth did resemble many other facets typical for this middle- to upper-class, residential environment. Specifically, the Big Thompson Canyon featured the parceling of land, the pastoral ideal of nature, the pleasure of modern conveniences, and the proximity to Front Range cities. In the prosperous decades following World War II, numerous homes—both large and small, permanent and seasonal, vacation and retirement—materialized upon the floodplain of the Big Thompson River. These suburban-like residences joined alternate dwelling places, such as motels and campgrounds, in more than doubling the riverine population within the Big Thompson Canyon. Altogether, a swelling number of canyon suburbanites during the Great Acceleration also meant a rising human vulnerability to a disastrous flood.[63]

As people flocked to the canyon, they often attached their motivations for doing so to the aesthetic, leisure, or recreational qualities of the Big Thompson Canyon. For some individuals, the place served as a "pristine canyon, a fishermen's paradise, and a vacation Mecca." [64] For others, the area functioned as "a quiet and peaceful alternative to the urban lifestyle."[65] Carolyn Hazzard Guillot, as an example, remembered taking holidays to see her canyon-bound father, Clarence Hazzard, and hiking with him in the gorge. She reminisced, "We admired all the flora, fauna, and geology… [because] the mountains and forest were twice as beautiful as they are now." On her sojourns, Carolyn also revered the "beautiful quaint homes; each nestled in its own special place next to the river."[66] Dorothy and James Venrick, who live in Drake since the mid-1960s, recollected, "We built our home and settled into this perfect and serene world of the Big Thompson Canyon. It was heaven on earth."[67] Residents were probably attracted to the Big Thompson River because they agreed with the Venricks—at least Jane Mckee and her husband did. When the Mckees bought their Glen Haven property in 1960, they named their cabin, "Little Bit of Heaven."[68]

With these pleasantries in mind, postwar travelers often frequented a rising number of motels, rental cabins, and campgrounds located in the Big Thompson Canyon. Whereas few accommodations stood within the gorge in earlier years, most notably the Forks Hotel in Drake, the Idlewild Lodge and Montrose Inn near Cedar Cove, the bulk of overnight lodging arrived after World War II.[69] By 1964, the number of motels along U.S. 34 within the canyon totaled thirty-two businesses (or thirty-five, including Devil's Gulch Road), like the Cedarmont and Seven Pines Motels positioned near Glen Comfort; the Waltonia and S.S. Rapids Motels situated in Waltonia; the Cha-Nel-Bo Lodge and Riverbend Motel located by Drake; or the Narrows Inn and Park Terrace Motel placed around Cedar Cove. A handful of campgrounds supplemented these establishments. To illustrate the density of lodging, at least one motel or campground existed, on average, for every mile of canyon highway.[70] Helen and Ray Hayden, operators of a Drake campground since 1946, remembered the popularity of these canyon accommodations. They remarked, "Our cabins and campgrounds were full and overflowing." [71] This metaphorical overflow of tourists, though, would become hazardous to people with the physical overflow of the Big Thompson River.

Similar to motel and campground growth within the Big Thompson Canyon, vacation homes were bursting out of their seams. By analyzing the remaining structures within the gorge, it appears that more than half of all residential development occurred during thirty-five year span from 1940 to 1975, with the most vigorous growth transpiring over the 1950s.[72] The amount of permanent dwellings within the canyon expanded from no more than two hundred homes in 1930 to almost eight hundred houses by 1975. This suburban-like expansion was partly responsible for an enlarging riverine population. In 1945, for example, nearly three hundred residents occupied the mountain gorge. By 1975, the canyon featured a full-time population of around six hundred people, which doubled to 1,200 residents during the summer months. Including tourists, an estimated 3,000 to 3,500 persons occupied the canyon by the summer of 1976.[73] Lucy Ann and

Russell Evans, a married couple who had lived in a riverside cabin since 1963, observed that the Big Thompson waterfront was "high-density living."[74]

Figure 2.5. A vacationer's cabin in Drake, 1950. Note the neighboring log house to the left. Courtesy Fort Collins Museum of Discovery Archives.

Suburbanization, consequently, refashioned the floodplain of the Big Thompson River. Rising affluence in American society, along with the boom in cars, highways, and fossil fuels, allowed for the emergence of what environmental historian Lincoln Bramwell has labeled "wilderburbs." Comparable to suburbs, wilderburbs were essentially ex-urban residential communities located on mountain ridges and valleys within driving distance of the city. Extending down the metropolitan fringe, the development of wilderburbs between the Big Thompson Canyon's walls—bolstered by U.S. 34—satisfied desires for both the splendor of natural surroundings and the security of amenity-rich, suburban living.[75] But the allure of wilderburbs also came with certain risks: for each new dwelling in the Big Thompson Canyon intensified susceptibility to a disastrous inundation in three different ways. Ex-urban growth concentrated more people in flood-prone areas along the river. The rooftops, driveways, and other impervious surfaces of wilderburb residences inhibited ground infiltration of storm water. And riverfront houses altered how the water actually flowed. All of this is complicated, though, because the last two factors have greater effects on small deluges and lesser impacts with large inundations. In any case, rather than riparian areas that adapted to barrages of water, suburban land-tenure impaired resiliency to potential flooding.[76]

Suburbanites of the canyon were not alone in being drawn to these metropolitan environments. Other foothills and mountain gorges of the Rockies succumbed to an urban periphery as the state of Colorado, the United States, and even the Earth, became entangled in suburban growth during the Great Acceleration. From 1940 to 1970, the metropolitan Front Range more than doubled in population, with most Coloradans settling down in suburban areas.[77] The overall ratio of the U.S. populace living in suburbia expanded more than two-fold between 1940 and 1970, from 13.4 percent to 37.1 percent.[78] And finally, the world's proportion of urban dwellers, including those in suburbia, escalated from 19 to 37 percent over the same time span.[79] By the 1970s, for the first time in U.S. history, more Americans lived in suburban areas than in either urban or rural settings.[80] During the Great Acceleration, for the first time in human history, the majority of people across the planet resided in urban-suburban complexes.[81]

* * *

If the rapid expansion of suburbia became one defining indication of the Anthropocene, then it would not have been possible without a world of commodities and consumerism. In the case of the Big Thompson Canyon, tourist enterprises and organizations transformed the landscape into a commercial product over time through advertising rhetoric. In the process of promotion, they also altered how people understood and experienced the Big Thompson River.

By highlighting only aesthetic, leisure, and recreational features, visitors and residents saw not a flood-prone landscape but a pristine “vacationland.” The Big Thompson Canyon was ready for vacationers to consume. Beyond just landscape qualities, however, sightseers and inhabitants alike depleted a material wealth in fossil fuels, too. As vehicular travel escalated along U.S. 34, automobiles burned greater amounts of motor oil and gasoline. As suburban occupation amassed within the gorge, vacation homes devoured more hydrocarbon byproducts such as asphalt shingles and vinyl siding. Like the eastern models in historian Lizbeth Cohen’s study, developing a western “landscape of mass consumption” in the Big Thompson Canyon would have been an impossible feat without coal and oil.[82]

Postwar tourism, overall, spurred changes to the perceptual and physical environments, paralleling broader trends that epitomize the Great Acceleration. For the Big Thompson Canyon, vacation literature, economic prosperity, transportation accessibility, and most importantly, fossil fuels combined to entice human encroachment of the floodplain. While individuals edged closer to the Big Thompson River, a sightseeing explosion occurred across the globe. International tourism receipts soared from two billion dollars in 1950, to twelve billion dollars in 1965, to a whopping forty-five billion dollars by 1975. Whether on a Rocky Mountain Motor Company tour in Colorado, or another Gray Line vacation package to the Bahamas, Canada, Mexico, Tahiti, Australia, or Hong Kong, fossil fuel-based technologies accelerated human travel and human currency around the Earth. These global developments, at least partly responsible for anthropogenic climate change, connected worldwide travelers to the visitors within the Big Thompson Canyon. On a summer evening in 1976, these canyon dwellers experienced another product of the Great Acceleration.[83]

## NOTES

[1] Rocky Mountain Motor Company, *The Gray Line: Denver and Rocky Mountain National Park* (1967), Newspaper Clippings: Subject- Colorado. Tourism, 1960-1969, Denver Public Library, Denver, CO (hereafter cited as DPL); Rocky Mountain Motor Company, *Sightseeing Tours Through Rocky Mountain National Park* (1953), Map G4312.R6A5, Stephen H. Hart Research Library, Colorado Historical Society (hereafter cited as CO-HIST).

[2] Union Pacific Railroad, *Colorado*, n.d., 19, Folder: Union Pacific Railroad Colorado Guide, Undated, Ephemera Box 1: Recreation Development, Rocky Mountain National Park Archives, Estes Park, CO (hereafter cited as ROMO Archives).

[3] Rocky Mountain Motor Company, *The Gray Line: Denver and Rocky Mountain National Park* (1967), Newspaper Clippings: Subject- Colorado. Tourism, 1960-1969, DPL; Rocky Mountain Motor Company, *Sightseeing Tours Through Rocky Mountain National Park* (1953), Map G4312.R6A5, CO-HIST.

[4] Hal K. Rothman, *Devil's Bargains: Tourism in the Twentieth-Century West* (Lawrence: University Press of Kansas, 1998), 10-22; Anne F. Hyde, "Cultural Filters: The Significance of Perception in the History of the American West," *Western Historical Quarterly* 24 (August 1993): 351-74; Mike Davis, *Ecology of Fear: Los Angeles and the Imagination of Disaster* (New York: Henry Holt and Company, 1998), 9, 35, 47.

[5] Lizabeth Cohen, *A Consumer's Republic: The Politics of Mass Consumption in Postwar America* (New York: Alfred A. Knopf, 2003), 6, 13-14; Rocky Mountain Motor Company, *The Gray Line: Denver and Rocky Mountain National Park* (1967), Newspaper Clippings: Subject- Colorado. Tourism, 1960-1969, DPL. For examples of postwar tourism outside of the United States, see Ellen Furlough, "Making Mass Vacations: Tourism and Consumer Culture in France, 1930s to 1970s," *Comparative Studies in Society and History 40* (April 1998): 247-64; Scott Moranda, *The People's Own Landscape: Nature, Tourism, and Dictatorship in East Germany* (Ann Arbor: University of Michigan Press, 2014), 1-15; and Anne E. Gorsuch, *All This is Your World: Soviet Tourism at Home and Abroad after Stalin* (New York: Oxford University Press, 2011), 1-5, 10-18. For the increasing importance of oil to the postwar consumer economy, see Joshua B. Freeman, *American Empire: The Rise of Global Power, the Democratic Revolution at Home, 1945-2000* (New York: Penguin Books, 2012), 19, 136-39.

[6] Estes Park Chamber of Commerce, *1956 Directory- Estes Park- Accommodations* (30 April 1956) Folder 1, MSP 1987:00.005, Estes Park Museum, Estes Park, CO (hereafter cited as EP Museum). For an environmental history of Colorado tourism in the postwar years, see William Philpott, *Vacationland: Tourism and Environment in the Colorado High Country* (Seattle: University of Washington Press, 2013), 4-20.

[7] From a social-psychological perspective, advertising has been shown to have little effect on an individual's consumer choices. Yet from a psycho-cultural approach, which this thesis draws on, promotional items seem to have a greater impact on people, especially at the collective level. For this discussion, see Arthur Asa Berger, *Ads, Fads, and Consumer Culture:*

*Advertising's Impact on American Character and Society*, Third Edition (New York: Rowman & Littlefield Publishers, 2007), 1-13, 31-32; Philpott, *Vacationland*, 5; Rothman, *Devil's Bargains*, 21-22.

[8] American Automobile Association-Rocky Mountain Region, *Where to Vacation in Colorado, 1970-1971*, page 110, Folder 4, Box 2: Estes Park Vacation Guides and Brochures, EP Museum.

[9] Estes Park Chamber of Commerce, *Estes Park, Colorado, and Rocky Mountain National Park – Open All the Year*, 1950s, Folder 1: Organizations- Estes Park Chamber of Commerce, MSP 2005:023.039-.044, EP Museum.

[10] Burlington-Northern Railway, *Colorado: The Perfect Vacationland*, 1940s, page 17, Box 1: Colorado Paper Souvenirs, EP Museum.

[11] David Louter, *Windshield Wilderness: Cars, Roads, and Nature in Washington's National Parks* (Seattle: University of Washington Press, 2006), 3-10, 164-71.

[12] Estes Park Chamber of Commerce, *Estes Park, Colorado*, 15 June 1964, MSP 2005:023.039-.044, EP Museum.

[13] Estes Park Chamber of Commerce, *How's the Weather in Estes Park?*, 1959, Folder 1: 1950-59, Box 1: Estes Park (EP) Vacation Guides, EP Museum; Estes Park Chamber of Commerce, *Estes Park Vacationland*, 1966, Box 6: Vacationland 1951-1966, EP Museum.

[14] W.W. MacGruder, Inc., Clayton Byers, Letter to Michael Marden, 6 March 1950, Folder 1, MSP 1987:00.005, EP Museum; W.W. MacGruder, Inc., Clayton W. Byers, "Proposal- Consideration of allotment of portion of advertising budget to publicity program," 1950, Folder 1, MSP 1987:00.005, EP Museum.

[15] Estes Park Chamber of Commerce, "Statement of Income and Expense for Twelve Months ending June 25, 1960," *Program of Work, 1960-1961*, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, Record Group 79: National Park Service, National Archives and Records Administration, Broomfield, CO (hereafter cited as NARA-RG79).

[16] Lyle H. McDowell, Letter to RMNP Superintendent, 9 November 1960, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, NARA-RG79; Lou Canaiy, Jr., "Minutes of the Meeting – The Tourist Study Committee – Estes Park, Colorado," 29 January 1965, Folder: A22 Chamber of Commerce, 1965, Box 1: 079-71-A0111, NARA-RG79.

[17] U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1984* (Washington, D.C.: Government Printing Office, 1983), 567.

[18] These figures were readjusted for inflation in the publication from Lester R. Brown, Michael Renner, and Brian Halweil, *Vital Signs, 1999: The Environmental Trends that Are Shaping Our Future* (New York: W.W. Norton & Company, 1999), 71.

[19] L.T. Davenport, Letter to RMNP Superintendent, 22 May 1958, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, NARA-RG79.

[20] Estes Park Chamber of Commerce, "Statement of Income and Expense for Twelve Months ending June 25, 1960," *Program of Work, 1960-1961*, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, NARA-RG79; William Philpott, "Stand by Your Brand: Vail, Colorado, and The Consumer Roots of Popular Environmentalism," in *Cites and Nature in the American West*, ed. Char Miller (Reno: University of Nevada Press, 2010), 225-41.

[21] *Cool Colorado: Vacation Wonderland!*, 1940 edition, page 10, Folder: Colorado 1938 978.8, Box 14: Geographic Files, 978.8 Colorado, 1930-1940-1951-1956, CO-HIST.

[22] Paul and Betty Solliday, "Emery and Marie Carter," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 131-33.

[23] Richard White, "The Problem with Purity," Tanner Lectures on Human Values, University of California-Davis, 10 May 1999.

[24] Eve C. Gruntfest, "What People Did During the Big Thompson Flood," Natural Hazard Research, Institute of Behavior Science, University of Colorado-Boulder, August 1977, 6.

[25] Robert E. Woznick, "S.S. Rapids Motel," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 128.

[26] "Jane Cracraft, "Volunteers Help in Canyon, BUT… Griffiths, in 70s, Won't Be Returning Where 'It Never Floods'" *The Denver Post*, 7 September 1976, Box 8, David McComb Big Thompson Flood Collection, Water Resources Archive, Colorado State University, Fort Collins, CO (hereafter cited as McComb Collection); John McPhee, *The Control of Nature* (New York: Farrar, Straus, & Giroux, 1989), 183-266. McPhee argues that Los Angelinos were often oblivious to the frequent debris flows because homeowners functioned on individual time while the floods adhered to geologic time.

[27] Frank Colohan, "Colo. 34 Assn. Is Formed Here," *Greeley Daily Tribune*, 21 May 1960; R.C. Haraden, Letter to RMNP Superintendent, 2 October 1961, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, NARA-RG79.

[28] R.C. Haraden, Letter to RMNP Superintendent, 10 December 1962, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, NARA-RG79.

[29] Trans-Mountain Road Association, *Your U.S 34 Highway now closed 8 months in Rocky Mountain National Park can be the MOST SCENIC ALL WEATHER CROSS COUNTRY ROUTE!*, 1961, Folder: A22 Chamber of Commerce, 1956-1962, Box 23: 079-71-A0111, NARA-RG79. For the difference between absolute and relational space, see Henri Lefebvre, *The Production of Space*, trans. by Donald Nicholson-Smith (1974; Oxford, UK: Basil Blackwell, 1991), 1-67.

[30] "Big Thompson / North Fork Canyons Recreation Acquisition Project," Folder 16, Box 1, Records of Wright Water Engineers, Inc., Water Resources Archive, Colorado State University, Fort Collins, CO (hereafter cited as WWE Records); "Annual Park Visitation (1904 – last calendar year)," Rocky Mountain National Park Reports, https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20%281904%20-%20Last%20Calendar%20Year%29?Park=ROMO (accessed 8 April 2015); McComb, *Big Thompson*, 9.

[31] Gordon G. Gauss, "U.S. 34 Suggestion May Spark Conservation Fight," *Greeley Daily Tribune*, 17 November 1970.

[32] Bob Johnson, *Carbon Nation: Fossil Fuels in the Making of American Culture* (Lawrence: University Press of Kansas, 2014), 150-62; Celia Lury, *Consumer Culture*, Second Edition (New Brunswick, NJ: Rutgers University Press, 2011), 1-55; Peter N. Stearns, *Consumerism in World History: The Global Transformation of Desire*, Second Edition (New York: Routledge, 2006), 47-65; Cindy S. Aron, *Working at Play: A History of Vacations in the United States* (New York: Oxford University Press, 1999), 1-11.

[33] Earlier numbers extrapolated from Rocky Mountain Park visitation and percentage taking the Big Thompson Canyon route to Estes Park. "Big Thompson / North Fork Canyons Recreation Acquisition Project," Folder 16, Box 1, WWE Records; "Annual Park Visitation (1904 – last calendar year)," Rocky Mountain National Park Reports, https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20%281904%20-%20Last%20Calendar%20Year%29?Park=ROMO (accessed 8 April 2015); McComb, *Big Thompson*, 9.

[34] L.J. Crampon, *The Tourist and Colorado* (Boulder: University of Colorado, Bureau of Business Research, 1956), 3, 6-9, 14, 27, 30-34, Box 14: Geographic Files, 978.8 Colorado, 1930-1940-1951-1956, CO-HIST.

[35] Kenneth T. Jackson, *Crabgrass Frontier: The Suburbanization of the United States* (New York: Oxford University Press, 1985), 246-71.

[36] For general history of Big Thompson Canyon Association, see Binder: BTCA History, Big Thompson Canyon Association, Drake, CO (hereafter cited as BTCA), especially A. Walter Lawson, Letter to B.V. Howe, 29 April 1942. For passing lanes, see Ray H. Black, Letter to Lawrence Bower, 15 January 1957, Binder: BTCA Minutes 1949-57, BTCA; Big Thompson Canyon Association, "Meeting Minutes," November 1958, Binder: BTCA Minutes 1958-63, BTCA; Big Thompson Canyon Association, "Meeting Minutes," 7 October 1959, Binder: BTCA

Minutes 1958-63, BTCA; Big Thompson Canyon Association, "Meeting Minutes," 6 April 1960, Binder: BTCA Minutes 1958-63, BTCA; Big Thompson Canyon Association, "Meeting Minutes," 1 March 1961, Binder: BTCA Minutes 1958-63, BTCA; and Big Thompson Canyon Association, "Meeting Minutes," 2 August 1961, Binder: BTCA Minutes 1958-63, BTCA; for turnout and picnic areas, see Big Thompson Canyon Association, "Meeting Minutes," 5 October 1960, Binder: BTCA Minutes 1958-63, BTCA; and Big Thompson Canyon Association, "Meeting Minutes," 1 February 1961, Binder: BTCA Minutes 1958-63, BTCA.

[37] Sharlynn Wamsley, ed., *Reflections on the River: The Big Thompson Canyon Flood* (Denver: Drake Club Press, 2001), 8.

[38] William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton & Company, 1991), 92, 207.

[39] Big Thompson Canyon Association, *Directory – Big Thompson Canyon Road* (June 1964), BTCA.

[40] Big Thompson Canyon Merchants Association, *The Big Thompson Canyon and Surrounding Area – Free Map* (1940s), BTCA.

[41] "Loveland Group to Stock Rainbow Trout in Streams," *Denver Post*, 1 May 1940, Binder: Fish / Sanitation Committee, BTCA; A. Walter Lawson, Letter to N. Dean Henry, 15 March 1939, Binder: Fish / Sanitation Committee, BTCA; N. Dean Henry, Letter to A. Walter Lawson, 2 May 1940, Binder: Fish / Sanitation Committee, BTCA.

[42] Irving M. Cannon, Letter to A. Walter Lawson, 26 September 1939, Binder: Fish / Sanitation Committee, BTCA; N. Dean Henry, Letter to A. Walter Lawson, 1 April 1940, Binder: Fish / Sanitation Committee, BTCA.

[43] "Loveland Group to Stock Rainbow Trout in Streams," *Denver Post*, 1 May 1940, Binder: Fish / Sanitation Committee, BTCA; Big Thompson Canyon Association, "Fish Planted this Summer," 15 October 1941, Binder: Fish / Sanitation Committee, BTCA.

[44] Jen Corrinne Brown, *Trout Culture: How Fly Fishing Forever Changed the Rocky Mountain West* (Seattle: University of Washington Press, 2015), 3-11, 65-91; Anders Halverson, *An Entirely Synthetic Fish: How Rainbow Trout Beguiled America and Overran the World* (New Haven, CT: Yale University Press, 2010), 76-93.

[45] Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (New York: Verso, 2011), 1-11.

[46] "Ike's Grandson Enjoys Camp in Rocky Mountains," *Greeley Daily Tribune*, 17 August, 1955; "President Slips into Colorado Vacation Routine," *Ellensburg Daily Record*, 15 August 1955, https://news.google.com/newspapers?nid=860&dat=19550815&id=QngKAAAAIBAJ&sjid=hUsDAAAAIBAJ&pg=2415,2229566&hl=en (accessed on 16 March 2016); "Ike Golfs, Plans

Trout Fishing Trip," *St. Petersburg Times*, 16 August 1955, https://news.google.com/newspapers?nid=888&dat=19550816&id=zGBSAAAAIBAJ&sjid=e3oDAAAAIBAJ&pg=5503,29291&hl=en (accessed on 16 March 2016).

[47] Elaine Tyler May, *Homeward Bound: American Families in the Cold War Era* (New York: Basic Books, 1988), 164.

[48] U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics, 1965* (Washington, D.C.: Government Printing Office, 1965), 54; U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics, 1975* (Washington, D.C.: Government Printing Office, 1975), III-2; Albina Tretyakova and Barry L. Kostinsky, *USSR: Motor Fuel Use and Conservation in Transportation and Agriculture, 1970 to 1984* (Washington, D.C.: Center for International Research, 1987), 54.

[49] Diane P. Koenker, *Club Red: Vacation Travel and the Soviet Dream* (Ithaca, NY: Cornell University Press, 2013), 10-11, 27, 167-208; Anne E. Gorsuch, *All This is Your World: Soviet Tourism at Home and Abroad after Stalin* (New York: Oxford University Press, 2011), 1-5, 10-18; Philpott, *Vacationland*, 54-73, 132-34.

[50] For the approximate amount of carbon emitted by automobiles on a given summer in the Big Thompson Canyon in the 1970s, I multiplied eight thousand vehicles, by thirty days, by four months, by twenty-five miles. Environmental Protection Agency, Office of Mobile Sources, "Automobile Emissions: An Overview," 1992; Environmental Protection Agency, Office of Transportation and Air Quality, "Questions and Answers: Greenhouse Gas Emissions from a Typical Passenger Vehicle," May 2014; Tom McCarthy, *Auto Mania: Cars, Consumers, and Environment* (New Haven, CT: Yale University Press, 2007), 236; Scripps Institution of Oceanography, "The Keeling Curve: A Daily Record of Atmospheric Carbon Dioxide," https://scripps.ucsd.edu/programs/keelingcurve/ (accessed on 24 August 2015); Joshua P. Howe, *Behind the Curve: Science and the Politics of Global Warming* (Seattle: University of Washington Press, 2014); EPI Data Center, "Miles Traveled by Cars, Trucks, and Motorcycles in the United States, 1960-2012," Earth Policy Institute, http://www.earth-policy.org/data_center/C23 (accessed on 24 August 2015); Arnulf Grübler, *Technology and Global Change* (Cambridge, UK: Cambridge University Press, 1998), 329.

[51] Waterdale Station, CO, US, COOP: 058839, "Annual Climatological Summary (1931)," National Oceanic & Atmospheric Association (hereafter NOAA), National Center for Environmental Information (hereafter NCEI); Waterdale Station, CO, US, COOP: 058839, "Annual Climatological Summary (1950)," NOAA, NCEI; Waterdale Station, CO, US, COOP: 058839, "Annual Climatological Summary (1976)," NOAA, NCEI; Waterdale Station, CO, US, COOP: 058839, "Annual Climatological Summary (2010)," NOAA, NCEI. For all these local NOAA reports, go to the following website and select "view data" for the desired years: http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:058839/detail (accessed on 26 August 2015). For regional climate data, see Andrea J. Ray et al., *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation* (Boulder, CO: Western Water Assessment, 2008), 10.

[52] "Climate at a Glance—Global Time Series," NOAA, NCEI, https://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/ytd/7/1880-2015 (accessed on 26 August 2015); "How much has the global temperature risen in the last 100 years?" University Corporation of Atmospheric Research, https://www2.ucar.edu/news/how-much-has-global-temperature-risen-last-100-years (accessed on 26 August 2015).

[53] James C. Knox, "Large increase in flood magnitude in response to modest changes in climate," *Nature* 361 (February 1993): 430-32; James C. Knox, "Sensitivity of modern and Holocene floods to climate change," *Quaternary Science Reviews* 19 (January 2000): 439-57; Maarten K. Van Aalst, "The impacts of climate change on the risk of natural disaster," *Disasters* 30 (March 2006): 5-18; D.B. Santer et al., "Identification of human-induced changes in atmospheric moisture content," *Proceedings of the National Academy of Sciences* 104 (September 2007): 15248-53, http://sa.indiaenvironmentportal.org.in/files/file/PNAS-2007-Santer-15248-53.pdf (accessed on 17 March 2016); Aiguo Dai, "Recent Climatology, Variability, and Trends in Global Surface Humidity," *Journal of Climate* 19 (August 2006): 3589-606, http://journals.ametsoc.org/doi/pdf/10.1175/JCLI3816.1 (accessed on 17 March 2016); A.J. Simmons et al., "Low-frequency variations in surface atmospheric humidity, temperature, and precipitation: Inferences from reanalyses and monthly gridded observational data sets," *Journal of Geophysical Research* 115 (2010): 1-21, http://eprints.maynoothuniversity.ie/6535/1/PT_lowfrequency.pdf (accessed on 17 March 2016); Katharine M. Willet et al., "Recent Changes in Surface Humidity: Development of the HadCRUH Dataset," *Journal of Climate* 21 (October 2008): 5364-83, http://eprints.maynoothuniversity.ie/6560/1/PT_recent%20changes%202008.pdf (accessed on 17 March 2016).

[54] Kevin E. Trenberth et al., "Observations: Surface and Atmospheric Climate Change," in *Climate Change 2007: The Physical Science Basis*, Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S.D. Solomon et al. (New York: Cambridge University Press, 2007), 262-73; Seung-Ki Min et al., "Human contribution to more-intense precipitation extremes," *Nature* 470 (February 2011): 378-81. U.S. Weather Service meteorologists did note that Big Thompson Canyon experienced high moisture content during the 31 July 1976 flood, see "Heavy Moisture Level Fueled Canyon Storm," *Boulder Daily Camera*, 2 August 1976, Folder 3, Box 3, WWE Records.

[55] For an example of each, see Mark Carey, *In the Shadow of Melting Glaciers: Climate Change and Andean Society* (New York: Oxford University Press, 2010); and David M. Tralli et al., "Satellite remote sensing of earthquake, volcano, flood, landslide and coastal inundation hazards," *Journal of Photogrammetry & Remote Sensing* 5 (June 2005): 185-98.

[56] T.N. Palmer and J. Räisänen, "Quantifying the risk of extreme seasonal precipitation events in a changing climate," *Nature* 415 (January 2002): 512-14; and P.C.D. Milly et al., "Increasing risk of great floods in changing climate," *Nature* 415 (January 2002): 514-17.

[57] P. Frich et al., "Observed coherent changes in climatic extremes during the second half of the twentieth century," *Climate Research* 19 (January 2002): 193-212; Gerald A. Meehl et al., "Understanding future patterns of increased precipitation intensity in climate model situations,"

*Geophysical Research Letters* 32 (September 2005); Claudia Tebaldi et al., "Going to the Extremes: An Intercomparison of Model-Simulated Historical and Future Change in Extreme Events," *Climatic Change* 79 (October 2006): 185-211; David R. Easterling et al., "Climate Extremes: Observations, Modeling, and Impacts," *Science* 22 (September 2000): 2068-74.

[58] Tim P. Barnett et al., "Human-Induced Changes in the Hydrology of the Western United States," *Science* 319 (February 2008): 1080-83.

[59] Charlene Morton Graham, "The Mortons," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 39-43.

[60] Peggy Lafferty, "Lafferty Family," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 33-34; Juanita and George Ashby, "Ashby Family," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 105; Tami Newlin, "Newlin Family," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 224-27; Vernon and Jeraldine Karstens, "Karstens Family," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 329.

[61] For details on when houses were built, use map and zoom in on particular properties: Larimer County Clerk and Recorder, "Property Information," Public Records Databases, http://maps.larimer.org/lil/?xCenter=2999439&yCenter=1483559&Scale=640000 (accessed on 9 September 2015). Betty Woodworth, "Big Thompson more than passageway to Estes Park," *Fort Collins Coloradoan*, special edition, August 1976, McComb Collection. In the article, Gertrude Randleman remembered, "There weren't very many cottages in the early days when I went up the canyon."

[62] Cohen, *A Consumer's Republic*, 6, 13-14.

[63] Dolores Hayden, *Building Suburbia: Green Fields and Urban Growth, 1820-2000* (New York: Pantheon, 2003), 1-18, 128-53; Robert A. Beauregard, *When America Became Suburban* (Minneapolis: University of Minnesota Press, 2006), 1-11, 28-37; Becky M. Nicolaides and Andrew Wiese, eds., *The Suburb Reader* (New York: Routledge, 2006), 1-9, 257-90; Lawrence A. Herzog, *Global Suburbs: Urban Sprawl from the Rio Grande to Rio de Janeiro* (New York: Routledge, 2015), 1-31; Adam Rome, *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism* (New York: Cambridge University Press, 2001), 1-13, 173-81; Jackson, *Crabgrass Frontier*, 3-11.

[64] "Big Thompson Rebuilding Rough," *The Sunday Camera*, 3 October 1976, Folder 8, Box 1, WWE Records.

[65] Big Thompson / North Fork Canyons Recreation Acquisition Project, Folder 16, Box 1, WWE Records.

[66] Carolyn Hazzard Guillot, “Hazzard Family,” in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 223-24.

[67] James and Dorothy Venrick, “Venrick Family,” in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 197.

[68] Jane McKee, “McKee Family,” in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 177.

[69] “History of Forks Hotel,” River Forks Inn, http://www.riverforksinn.com/history.html (accessed on 3 September 2015); Drake Home Demonstration Club, *History of the Big Thompson Canyon* (Larimer County, CO: Works Progress Administration, 1939), 2-3, 10, Western History Collection, DPL.

[70] Big Thompson Canyon Association, *Directory – Big Thompson Canyon Road* (June 1964), BTCA; Denver Convention and Visitor’s Bureau, *1952 Directory – Colorado Mountain Accommodations*, Folder 1: 1950-59, Box 1: Estes Park (EP) Vacation Guides, EP Museum.

[71] Helen Hayden, “Hayden Family,” in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 216-17.

[72] Larimer County Clerk and Recorder, “Property Information,” Public Records Databases, http://maps.larimer.org/lil/?xCenter=2999439&yCenter=1483559&Scale=640000 (accessed on 9 September 2015).

[73] During the early 1930s, construction reports show only twenty-nine houses (“cabins”) in the town of Drake (the largest hamlet in the Big Thompson Canyon). For details, see Colorado State Highway Department, Plan and Profile of Proposed Federal Aid Project No. 9-R-5, Right-of-way map, Sheet, 17, CDOT-OTIS. Col. J.H. William, Letter to Ben H. Gregg, 15 July 1942, Binder: BTCA History, BTCA. David McComb’s study claimed 1,400 houses occupied the canyon, but a detailed study by Wright Water Engineers revealed fewer. See McComb, *Big Thompson*, 9; David De Voss, “No, There’s Nothing There,” *TIME Magazine*, 16 August 1976, 22, Box 8, McComb Collection; Kenneth R. Wright, Memorandum to Willard Quirk and Larimer Country Commissioners, 12 November 1976, Folder 15, Box 1, WWE Records; and Kenneth R. Wright, Memorandum to Governor Richard Lamm, 8 July 1977, Folder 19, Box 1, WWE Records.

[74] Lucy Ann and Russell J. Evans, Letter to Richard Lamm, 20 September 1976, Folder 19, Box 1, WWE Records.

[75] James T. Patterson, *Grand Expectations: The United States, 1945-1974* (New York: Oxford University Press, 1996), 340; Lincoln Bramwell, *Wilderburbs: Communities on Nature’s Edge* (Seattle: University of Washington Press, 2014), 3-11.

[76] Ben Wisner et al., *At Risk: Natural Hazards, People’s Vulnerability and Disasters*, Second Edition (New York: Routledge, 2004), xi-xii, 5-16; Environmental Protection Agency,

*Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation, and Environmental Quality* (Washington, D.C.: Government Printing Office, 2000), 16-17, https://archive.epa.gov/greenbuilding/web/pdf/built.pdf (accessed on 16 March 2016).

[77] The "metropolitan Front Range" includes the following counties: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, El Paso, Elbert, Gilpin, Jefferson, Larimer, Park, Pueblo, Teller, Weld. The area grew from 691,487 people in 1940 to 1,787,175 people by 1970. For Colorado census data, see "Historical Census Population," Department of Local Affairs, State of Colorado, https://dola.colorado.gov/demog_webapps/hcpParameters.jsf (accessed on 13 September 2015).

[78] See Figure I-1 in Nicolaides and Wiese, eds., *The Suburb Reader*, 2.

[79] United Nations, Department of Economic and Social Affairs, *Growth of the World's Urban and Rural Population, 1920-2000* (New York: United Nations, 1969), 31; United Nations, *The World's Women 2000: Trends and Statistics* (New York: United Nations, 2000), 9.

[80] Hayden, *Building Suburbia*, 10.

[81] In 2008, a majority (50.5%) of people lived in metropolitan areas, a trend which continues to rise to this day. For these statistics, see "Urban Population (% of Total)," World Bank, http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries?display=graph (accessed on 13 September 2015). The following article, which argues that planet is undergoing a "great suburbanization" trend, notes that "in developed and developing worlds, outskirts are growing faster than cores." See "A Planet of Suburbs," *The Economist*, 1 March 2014, http://www.economist.com/suburbs (accessed on 13 September 2015).

[82] For an overview of commodities and consumerism, see Ted Steinberg, *Down to Earth: Nature's Role in American History*, Third Edition (New York: Oxford University Press, 2013), 57-300. Philpott, *Vacationland*, 4-20; Cohen, *A Consumer's Republic*, 6, 13-14.

[83] World Tourism Organization, *UNWTO Tourism Highlights*, 2011 Edition, http://mkt.unwto.org/sites/all/files/docpdf/unwtohighlights11enhr.pdf (accessed 9 April 2015); World Bank, "International tourism, receipts (current US$)," http://data.worldbank.org/indicator/ST.INT.RCPT.CD (accessed 9 April 2015); "International Tourism Receipts," http://stats.areppim.com/stats/stats_itr.htm#itr_actual (accessed 9 April 2015).

# CHAPTER THREE

## ACCELERATING FLOODS, ACCELERATING DECISIONS

Saturday, July 31, 1976, was supposed to begin a remarkable weekend in the Big Thompson Canyon. Celebrations abounded in Estes Park and the surrounding areas for two reasons— Colorado's centennial anniversary for statehood and the United States' bicentennial anniversary for nationhood. The famous Stanley Hotel hosted an outdoor concert series in honor of these occasions. Many Americans, too, huddled near television sets to watch the final athletic events of the Summer Olympics—hosted by Montreal, Canada—as the Soviet Union and East Germany competed with the United States for most medals. Families also enjoyed the waning days of vacation time as Sunday turned to August, the final month of summer. And most especially, tourists bustled along U.S. Highway 34 to get in on these festivities. Alice and Bob Gifford, residents of the canyon, recalled: "All the neighbors were coming to their homes for the long weekend—Colorado's $100^{th}$ birthday. All the motels were filled to capacity with happy vacationers. The streams and the Big Thompson River were full of fishermen."[1]

In the end, the weekend *was* remarkable, albeit for different reasons. Near the late afternoon on Saturday, Gary Haxton, his wife, and their three youngest children returned to their family cabin at Waltonia. The Haxtons had spent the earlier part of the day at their oldest daughter's wedding in Estes Park, before returning to their summer home within the Big Thompson Canyon. Upon return, they decided to grill some hamburgers for dinner, but showers began at around 6:30 p.m. and interrupted their meal. Tired from nuptial festivities, they opted for an early bedtime a couple hours later during an intense downpour. The Haxtons retired to their screened-in back porch where they slept no more than thirty feet from the Big Thompson

River. Around 9 p.m., their electricity went out. Gary peered outside and noticed the entangled reality of road and river, of human artifice and natural torrent: “I looked out, watching cars…going up and down Highway 34…And then laid back down and then a few minutes later…looked out, and all I could see was water.” As the Haxtons scurried up higher ground to safety on that night, anthropogenic and environmental forces collided to produce a remarkable flood. The inundation not only represented Earth-system changes of the Great Acceleration, but certain ideas behind the Great Acceleration also restricted post-flood deliberations.[2]

During the Anthropocene, people became geophysical agents within the Big Thompson Canyon. Like the Big Thompson River over millennia, the cumulative build-up of human efforts over the Great Acceleration—from highway construction to automobile tourism to suburban land-tenure—rapidly altered landscape and climate. These ecological changes, as unintended consequences of a fossil fuel-based society, strengthened the destructive power of the 1976 deluge. The river itself was still a geophysical agent, too. Heavy rainfall and concentrated runoff delivered periodic inundations that had shaped canyon topography in the first place. This understanding of the Big Thompson Flood calls into question its interpretation as “natural disaster”; however, it was not totally human-caused either.[3] The 1976 flood, in reality, occupied a sort of middle ground, a hybrid space, where human and natural worlds became further enmeshed. Riverine inhabitants, along with their houses, cars, and other belongings, were caught amid this messy combination.[4]

In the flood’s aftermath, the paths for disaster recovery were fairly limited. People had so immensely tailored the Big Thompson Canyon towards elements of the Great Acceleration that transportation infrastructure and land-use practices gained a momentum of their own. No longer could most Coloradans see the canyon without a reconstructed highway, or without a revival of tourism, or without a restoration of suburbia. So when political debates arose after the deluge about how to best proceed with recovery efforts, the momentum from the Great Acceleration carried over into post-flood discussions. When deliberating about whether or not to rebuild U.S. Highway 34, or about how to approach floodplain zoning, some Coloradans offered viable alternatives for the canyon. Few individuals, though, genuinely considered them. In many ways, societal commitments to various facets of the Great Acceleration prevented any sort of rupture from prevailing, pre-flood circumstances.[5]

*The Hybrid Torrent of a "Thousand- Year" Flood*

Earlier, when the Haxtons had first arrived at their cabin, large thunderheads started to form over northern Colorado's Front Range. Convective activity rattled a moist air mass, possibly engorged with water vapor from the hybrid result of humans and hydrocarbons—namely, anthropogenic climate change. The bustling atmosphere generated scattered rainfall, explosive lightning, and resounding thunder. At 7:35 p.m., the National Weather Service in Denver released its first of three messages that night: "BULLETIN FOR IMMEDIATE BROADCAST REQUESTED… RADAR INDICATED A SEVERE THUNDERSTORM 10 MILES SOUTHWEST OF FORT COLLINS… THERE COULD BE SOME FLOODING OF LOW AREAS…"[6] By the time the forecast aired on radio and television stations, an easterly gale pushed the weather cell over the face of the Rockies and caused a "premature sunset." Eastern winds overpowered any western breeze, forcing the band of weather to halt over the mountains. Harold Tregent, who ran the Glen Comfort Store, observed, "It seemed that the cloud cover just didn't move."[7] From about 6:30 p.m. until 11:00 p.m., the storm cell became almost stationary over the western third of the Big Thompson Canyon.[8]

The waterlogged clouds, via orographic uplift, finally burst. Heavy rainfall dropped in a seventy square-mile-area located between Estes Park and Drake. In a short time span, just over one hour, 7.5 inches dumped in the epicenter of the storm; and in four hours, twelve to fourteen inches fell towards the ground. The downpour, to illustrate its severity, almost matched the yearly average in *total* rainfall for the region. Terry Sandoval and Connie Hays, who traveled down U.S. 34 on that night, remembered, "The rain was coming down so hard the windshield wipers were literally useless."[9] The deluge quickly filled the moisture-holding capacity of the thin soils; and once the earth was saturated, water started to amass over the ground. The overland flow collected in smaller ravines and gulches, turning calm rivulets into booming streams. This outpouring eventually amassed within the primary channel of the river; the flash-flood conditions yielded "walls of water" that most observers had never before seen.[10] From the evening of July 31 to the morning of August 1, the Big Thompson Flood overran the canyon.[11]

Human elements interwove with natural features on the river, heightening the disastrous velocity of the deluge. The steep walls of the gorge joined the broad roadbed of the highway to constrict the watercourse of the Big Thompson River. The same amount of water churned down the canyon; but like placing one's thumb over a garden hose, the concentration of stream flow increased its hydraulic power. Tim Littlejohn, a police officer with the Colorado State Patrol, noticed the torrent's swift pace around 8 p.m. when he arrived at Drake. Responding to large, geologic material reported on U.S. 34, he remembered, "The river was already bank to bank and going very fast. I didn't really know, but whatever came down that canyon wouldn't be contained within the river."[12] Between 9 p.m. and 10 p.m., water levels peaked at an astounding 19.7 feet above a normal depth of eighteen inches. Floodwaters accelerated down the canyon via paths straightened for automobile infrastructure and slowed only when they smashed into the curving walls of the gorge. At Drake where the North Fork and main stem of the Big Thompson converge, an astounding 32,700 cubic feet per second (CFS) overwhelmed the tourist hamlet. At the Narrows located a few miles west of Loveland, an equally staggering 31,200 CFS roared from the mouth of the canyon. This flood pulse enveloped Sergeant Willis Hugh Purdy of the Colorado State Patrol, one of first patrolmen on the scene who tried to warn residents about the impending torrent. Just after 9 p.m., Purdy's dispatch officer registered his final report: "I'm stuck, I'm right in the middle of it, I can't get out…."[13]

The floodwaters alone were a jumble of human and nonhuman nature. The river, for example, carried "broken-up trees, uprooted bushes, [together with] pieces of trailers and campers."[14] The barrage propelled large boulders—one weighed 275 tons—alongside both unoccupied and peopled automobiles. Dorothy Ferguson, who had lived in Glen Haven since 1956, observed that numerous cars, a bus, her own propane tank, and "all sorts of things started coming down the river."[15] The six bridges erected for the highway acted as makeshift dams for sediments and debris to collect. Once enough water collected behind these temporary barriers, the obstructions burst open and released periodic surges.[16] John Hennessey, camping with his wife and four other couples next to the Big Thompson River, recalled that the deafening mixture of water and wreckage roared "like a jet airplane."[17] Using an industrial metaphor to describe a natural process, the inundation left a virtually denuded landscape as Hennessey and his fellow campers all fled.

The flood damaged—and in many cases demolished—much of the human-built infrastructure within the canyon. U.S. Highway 34, for instance, crumbled in many sections as landslides destabilized the structure from above while water currents undercut it from below. The hydraulic force behind the torrent literally picked houses up from their foundations. Vena and Al

Winslow, who built their cabin in 1961, observed that "all that remained was a cement step that went into the front door."[18] The deluge went on a rampage through gorge: destroying 418 homes, damaging another 138 dwellings, leveling 52 businesses, wrecking 438 vehicles, and shattering numerous telephone and power lines. The floodwaters even ripped the massive, 550-ton water irrigation siphon tube that had crossed the river at the mouth of the canyon. In all, the inundation caused over $35.5 million in property losses.[19] Virginia Shannon reacted to her pummeled vacation home near Glen Comfort: "I don't expect to ever again feel as small, nor realize so intensely, how little control we actually have over our lives as I did when I looked at the debris and destruction everywhere in the canyon."[20]

Figures 3.1-3.4. *Clockwise from right*: an aerial view of the Big Thompson Flood, a car teetering on an eroded bank, auto wreckage in the flood's aftermath, and a house perched upon a bridge. Courtesy of Maurice L. Albertson Papers, Water Resources Archive, Colorado State University Libraries.

The emergency efforts from federal, state, and local governments, as well as voluntary measures, attempted to save as many people as possible from the flood. Initially, police officers erected roadblocks to turn motorists away from U.S. 34 and cautioned the riverine population to evacuate their residences. Many individuals in the lower sections of the canyon, though, did not believe the flood warnings and refused to leave. Governor Richard Lamm, notified of the catastrophe at 3:15 a.m., declared a “state of disaster emergency” in order to coordinate assistance. The U.S. Army National Guard, in addition to supplying troops, sent helicopters into the canyon at dawn to rescue trapped survivors. They pulled 850 people out in a single day. Other federal entities, like the National Park Service and U.S. Forest Service, offered aid alongside church groups, local businesses, and concerned citizens. The Salvation Army and American Red Cross, furthermore, provided food, shelter, and clothing to all flood survivors. John Englebert, captain of the Larimer Country Sheriff’s Office and director of the rescue operations, estimated that emergency services evacuated seventy-five percent of the canyon inhabitants by Sunday night.[21] And yet not everyone could be secured by crisis-relief measures. “Come morning,” uttered Larimer County Sheriff Robert Watson, “we are going to find bodies all over the damned place.”[22]

The flood, despite the emergency response, took a devastating human toll. Those individuals who climbed to higher ground—like the Haxtons—had the best chance of surviving the barrages of water, while those persons who tried to escape by automobile or who stayed in their homes had the least.[23] Marilyn Henderson, for example, a twenty-five-year-old vacationer from Oregon, was traveling in the canyon with four friends by car to see Rocky Mountain National Park over the weekend. Between 9 p.m. and 10 p.m., the inundation carried their vehicle off U.S. 34. On that tragic night, Henderson recalled: “The car rolled and tumbled into the river. It was horrible….Water was coming in. When it got neck-deep, I rolled down the window and passed each of the other four girls out. I was the last out.”[24] When Henderson escaped from the automobile, a powerful current swept her a quarter-mile downriver until she clutched onto a tree. Henderson and one friend survived the deluge. Her three other companions did not. At about the same time the sightseers clung to life, Renee and James Mares, along with their three children, hunkered down within their riverfront house in Cedar Cove. They had moved to the canyon in 1968 because “it was peaceful and pretty up there”; and Renee was commuting to work at the Hewlett-Packard Computer Company in Loveland. With little warning, the torrent swept away their home—all five perished in the deluge.[25]

Altogether 143 people died.[26] The inundation mangled some victims to the point that dental and fingerprint records were the only means to identify the bodies. Eighty-eight persons, moreover, required medical attention for sustained injuries. The geographical origins of the flood victims, by percentage, split roughly into thirds between permanent inhabitants of the canyon, seasonal vacationers from Colorado, and out-of-state tourists. Approximately twenty percent of the flood victims had stayed at overnight campgrounds within the canyon.[27] About half of the deaths also comprised of people over the age of fifty, which meant that many of the disaster fatalities were likely retirees.[28] The Big Thompson River Flood of July 31 to August 1, 1976, driven by an entanglement of human and natural factors, was a catastrophic extreme event.

Once the floodwaters receded, newspapers and commentators quickly seized onto the idea that the torrential downpour had delivered a “thousand-year flood.” The press utilized the term—denoting a 0.1% probability of an inundation of the same size occurring in any given year—to suggest the extraordinary nature of the Big Thompson Flood.[29] After studying the floodplain, water-resource engineers arrived at a slightly lower figure, calling the 1976 deluge a 333-year flood instead. Still, the Big Thompson Flood was considered highly atypical at the time as its designation translated to a 0.33% probability, annually, for a barrage of equal magnitude.[30] A 1988 study further augmented this notion. By examining ancient debris piles and estimating stream flows, two paleo-hydrologists arrived at the conclusion that the Big Thompson Canyon had not experienced an extreme event like the 1976 flood for the last ten thousand years. Their scholarship meant that the last inundation of comparable size occurred at the end of the last Ice Age, the Pleistocene epoch.[31] From a local perspective, the deadliest flood in Colorado's history appeared to be highly unusual, and even unique.

But from a broader framework, the flood tells a different story. It conveys that as global atmospheric carbon dioxide has exponentially risen over the Great Acceleration, inundations like the episode in the Big Thompson Canyon have become more common. For thirty-two of the most significant deluges in the United States during the twentieth century (the 1976 flood included), over *eighty percent* transpired from 1950 onwards.[32] From 2,089 total reported inundations worldwide between 1900 and 2000, over *ninety percent* took place since 1950.[33] Even if correlation does not equal causation, a meaningful connection still exists. One professional sport offers a useful analogy. "Over the course of a baseball season in the steroid era, we witnessed more—and longer—home runs, even though we cannot attribute any specific homer to steroids," one national science panel has declared. "Similarly, even though we cannot attribute any particular weather event to climate change, some types of extreme events [such as floods] are now more frequent."[34] The group resolved, "Greenhouse gases have supercharged the climate, just as steroids supercharged hitting in Major League Baseball."[35] From a global view, then, the 1976 Big Thompson Flood was not exceptional. Instead, it represented one of a swelling number of giant floods during the Great Acceleration of the Anthropocene.[36]

### *To Rebuild or Not to Rebuild?*

In the months after the deluge, Harry "Corky" Rogers, director of the Estes Park Chamber of Commerce, worried about reclaiming the tourist economy. According to Rogers's estimates, the Estes Park region witnessed a sixty-five percent drop in local business, for a total deficit of $40 million if the summer vacation season did not pick up soon. These figures, though exaggerated, were meant to prove a point.[37] "The dollar loss in the disaster area is tremendous," Rogers declared. "But if people continue to stay away from Estes Park, and Rocky Mountain National Park, the loss in revenue to the area could very well match that of losses in the flood area."[38] Besides publicizing that Estes Park was relatively unscathed by the inundation to lure motorists, Rogers became one of the chief proponents for the immediate reconstruction of U.S. Highway 34 in the Big Thompson Canyon. "The canyon is an end in itself," the Chamber director remarked, "people come here to see it."[39] Rogers determined that "economically we can't afford *not* to have that road."[40]

In other words, Rogers and other commercial interests had come to rely on the conditions that fostered the Great Acceleration. They also committed themselves to recreating those features within the Big Thompson Canyon. An endless number of automobiles along U.S. 34—many of which carried tourists to Estes Park and RMNP—became the physical embodiment of unceasing economic progress. Despite limitations to the prevailing route that the Big Thompson Flood exposed, the highway itself sustained what historian of technology Thomas Hughes has called "momentum." This term describes when societal investment imbues physical artifacts, such as electrical systems or road technologies, with cultural values that make them very challenging to diverge from, even if better options exist. And like the momentum of a speeding car, it caused difficulties when one wanted to reduce speed, to take a different path, or to even maneuver a U-turn. A few Coloradans tried to step on the brakes or to grab ahold of the steering wheel during political deliberations—to slow down and cautiously think about the safest route, to discuss alternative routing for the expressway, or to even abandon its highway status altogether. While numerous positions developed over the fate of U.S. 34, business interests, canyon inhabitants, and preexisting legislation pressed the accelerators to the floor. The Great Acceleration generated momentum that proved hard to break away from.[41]

Nearly all major decisions for canyon recovery would be resolved at the local level. After the flood, Governor Richard Lamm had granted executive powers to the Larimer County Commissioners (LCC). On August 14, 1976, Warren Wolaver, one of three county officers with decision-making authority at the time, specified that "the Commissioners will ask the people what should be done, not other interests."[42] For the sake of warding off administrative inefficiency, however, Lamm suggested that an intergovernmental task force be established. On August 20, the LCC officially created the Big Thompson Advisory Committee—later reformulated as the Big Thompson Recovery Planning Council (BTRPC)—in order to coordinate efforts among various government levels. The Council eventually consisted of three state representatives, one individual each from the Department of Highways, Land Use Commission, and State Geological Survey; three county commissioners; a total of four mayors from the cities of Estes Park, Loveland, Fort Collins, and Greeley; two canyon residents; and an associate of the Northern Water Conservancy District. In addition to these thirteen members, engineer Willard Quirk operated as county flood coordinator, while Kenneth Wright, a water-resources engineer, served as both the chair of the Council and a special consultant to Lamm.[43]

At weekly meetings, which later turned to monthly gatherings, the BTRPC pursued two principal objectives. First, the Council sought to redevelop canyon homes and businesses "in accordance with sound flood plain zoning criteria." And second, it desired to construct a new highway "in a safe manner" with respect to facilitating automobile tourism.[44] Regarding the latter goal, council representatives were cognizant of the fact that U.S. 34 contributed to river channelization and flooding risk. For example, four days after the deluge, on August 4, local architect Robert Phillips wrote to Lamm, who then relayed the message to Wright, about the impact of road infrastructure on inundations. Phillips commented that “by placing [a] major artifact of industrialized man in close proximity” to the Big Thompson River, “the conflict of the past week is due to occur and reoccur.”[45] Larry Simpson, a member of the water conservancy district, concurred, “I really question whether they need a road in that canyon. If it’s built back up we are faced with the knowledge that eventually it’s going to happened again.”[46] At the BTRPC sessions, Quirk noted that “the channelization problem was discussed at length, without any firm solution being brought to light.”[47] On September 3, a *Denver Post* newspaper article encapsulated many apprehensions concerning road construction: “How the highway is rebuilt, actually, can have considerable effect in minimizing future damages.”[48] In short, bolstering canyon safety via the pending road became a top priority for government officials.

As a result, district engineer Dwight Bower of the Colorado Department of Highways prepared five options for the BTRPC to consider as highway infrastructure. The first possibility was the rebuild U.S. 34 in the Big Thompson Canyon. The road would basically follow the same path as when first built in the 1930s; but according to chief highway engineer Jack Kingstlinger, it would be upgraded to “modern engineering standards.” The second prospect was the Poll Hill route. A brand-new highway would be constructed within this dry gulch, laying road down about five miles south of the canyon. The third and fourth selections were motorways in either Dickson Gulch or Quillan Gulch. These potential thoroughfares would trace the Poll Hill route until they ultimately turned northward, heading back into the Big Thompson Canyon at either Cedar Cove or Waltonia, respectively, and thus avoiding the Narrows or the eastern half of the canyon. The fifth alternative was to expand U.S. Highway 36 from two to four lanes. By moving more traffic volume into the St. Vrain Canyon between Lyons and Estes Park, the Big Thompson Canyon's highway designation could then be abandoned. While the BTRPC discussed these options, the Colorado Department of Highways erected a crude, single-lane "pioneer road" in the canyon as a temporary solution for cleanup operations and resident access.[49]

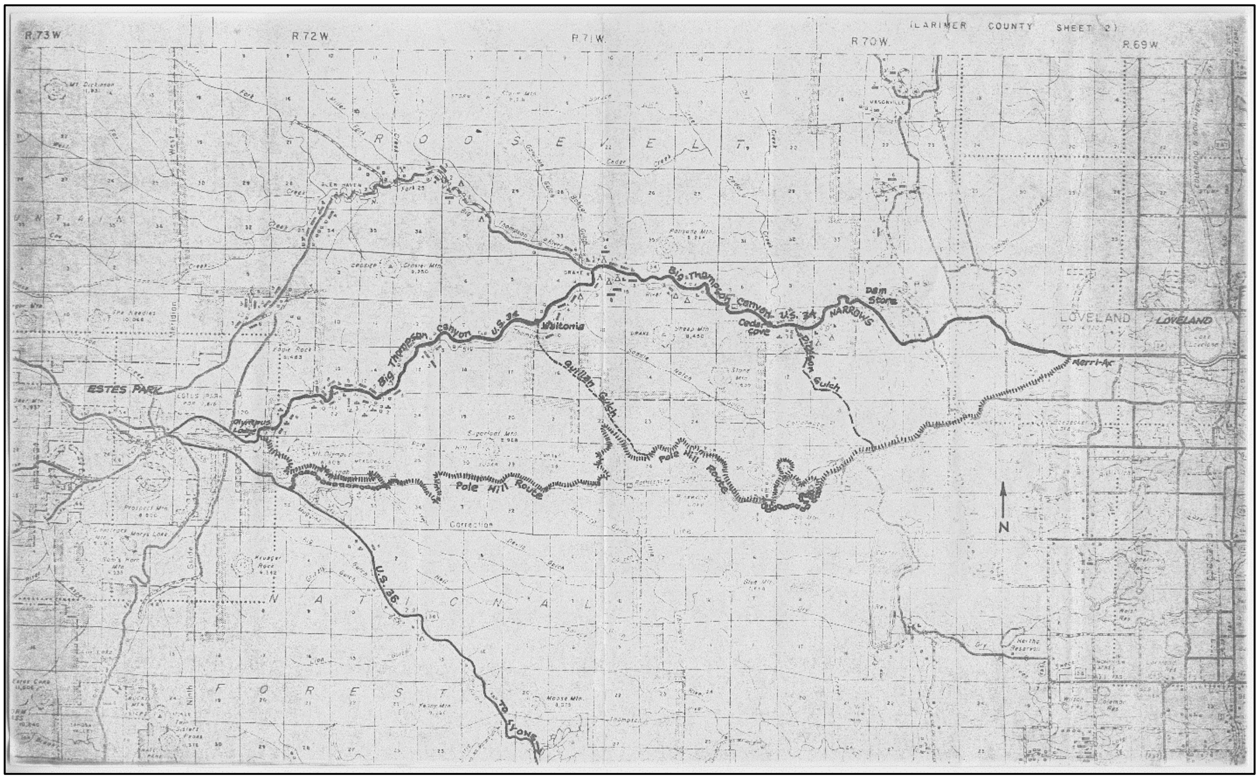



Figure 3.5. A map illustrating the five highway routes briefly considered after the Big Thompson Flood. Courtesy of Records of Wright Water Engineers, Inc., Water Resources Archive, Colorado State University Libraries.

Federal laws—adapted in many ways towards the Great Acceleration—hindered a full consideration of alternative expressways almost from the beginning. A day after the torrent, on August 2, 1976, President Gerald Ford declared Larimer County a "major disaster area" under the Federal Disaster Relief Act of 1974. The executive announcement, while freeing up public money within the Federal Disaster Assistance Administration for canyon recovery, dampened the likelihood of potential changes to highway routing.[50] The federal government "provides 100 percent reimbursement" for road construction under this legislation, but it would only do so "if road is replaced in original form."[51] The BTRPC *could* select different highway paths; then again, state and local governments would be required to foot at least part of the bill, thus making alternative options less desirable. In sum, federal disaster status added to the momentum of U.S. Highway 34.

Another law that hamstrung prospects of choosing a different route was the National Environmental Policy Act (NEPA) of 1969. Under normal circumstances, NEPA demanded cautious and thoughtful development. The act required that all major projects utilizing federal dollars go through an extensive cost-benefit analysis, known as an environmental-impact statement (EIS), in order to curtail irreparable damages to surrounding ecosystems. In the case of existing infrastructure, though, the law actually undermined its intended purpose. For the Colorado Department of Highways, NEPA mandated that every new route—meaning every *alternative* route—undergo an EIS examination, while the original canyon path did not. In terms of temporal and financial commitment, NEPA determined that all other highways would now take twice as long to build and cost twice as much to construct. With speed as a value during the Great Acceleration, routing that stalled human activity was seriously disadvantaged.[52]

Business interests wanted the U.S. 34 route to be restored as quickly as possible in order to avoid an economic slowdown. Al Hall, a local businessman, postulated on what might happen to the tourist industry if enough vacation plans changed due to highway access. "The area could possibly be subjected to a worse disaster than which hit the Big Thompson Canyon," Hall stated, "an economic disaster."[53] The vice president of the Loveland Chamber of Commerce reasoned in similar terms. "The plain, simple answer," Dennis Anderson remarked, "is that without that highway we don't have any tourist traffic."[54] From an economic vantage point, the original path became the only rational option. On August 26, 1976, Corky Rogers and the Estes Park Chamber of Commerce called for “the immediate and complete restoration of U.S. Highway 34 through the Big Thompson Canyon with a completion date of said restoration by June 1, 1977.” In addition, the organization stressed that it “does *not support* any alternative locations for this restoration.”[55] On September 8, the Loveland Chamber of Commerce expressed much the same opinion. The group asked that “all necessary red tape be eliminated to insure…that construction on U.S. Highway 34 in the Big Thompson Canyon…should not be delayed.”[56] For commercial stakeholders, a reestablished road promised an expanding capitalist economy.[57]

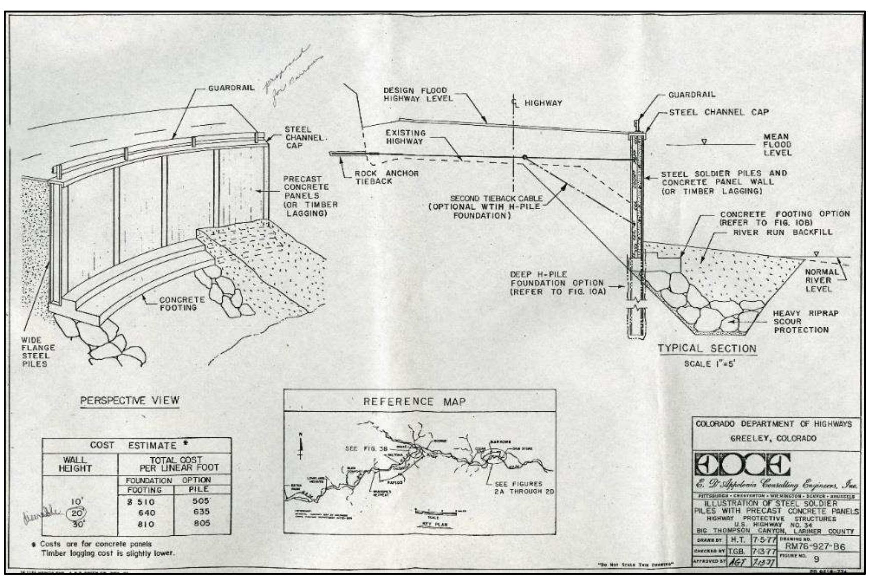
As pressures mounted, the BTRPC tried to resist the path-dependence, or the similar historical trajectory, that had built up over the Great Acceleration. “We had to state safe road criteria loud and clear,” council chair Ken Wright stated. “Business interests [were] bulldogging [the] decision!”[58] Canyon inhabitants, however, also pressed for the original route, supplying additional momentum that engulfed the BTRPC. According to an opinion survey, eighty-six percent of 322 canyon dwellers “favor the pre-flood location of the highway, improved to modern standards.”[59] Commenting on resident input, Wright observed that “considerable criticism arose over the suggested alternative[s].”[60] With tourism businesses, canyon inhabitants, and preexisting laws working against any potential changes, the BTRPC capitulated.[61] On September 1, 1976, only *one month* after the flood, the Council gave a *unanimous* vote. They recommended that the Colorado Department of Highways should rebuild the highway in the Big Thompson Canyon with engineering specifications “to protect the highway from the one percent (100 year) flood and related erosion.”[62] As one council member noted about the outcome, U.S. 34 was “the only route that would not result in a loss of economic activity,” but it would “have the highest flooding impact.”[63]

Environmental groups were not impressed with the highway decision. By the time of the Big Thompson Flood in the mid-1970s, the environmental movement had permeated throughout much of the United States. From Rachel Carson's 1962 *Silent Spring* to the 1970 Earth Day teach-in—an ethic of interdependence had molded some American minds, or at least had influenced them to care about nature.[64] From an ecological outlook, reconstructing U.S. 34 within the Big Thompson Canyon appeared to be a grievous mistake. On September 14, 1976, Mary Taylor, president of the Colorado Open Space Council, wrote an open letter to Lamm that expressed the association's misgivings about reestablishing the original path. The advocacy group endorsed the position that "the highway should be built to fit the river, not fit the river to the highway by channel modification."[65] Eight days later, James Disney, chairman of Loveland's Environmental Quality Commission, composed a message for Kinstlinger of the Colorado Department of Highways. The commission expressed their "strong reservations as to the wisdom of rebuilding Highway 34 through the Narrows of the Big Thompson Canyon."[66] In general, environmentalists believed that people should consider the health of Big Thompson River as a hydrological system in service to biological well-being and human safety. These matters, above anything else, should come before the speedy reconstruction of the highway.[67]

Governor Lamm shared in these environmental concerns. But for many state officials, Lamm included, the cultural momentum of the Great Acceleration commanded most of their thoughts. A similar logic about technological solutions for environmental problems, which had guided engineer Charles Vail some forty years earlier, appeased the ultimate worry about a safe highway. "I must admit that I'm bothered about putting a permanent wider road thru [*sic*] the Narrows," Lamm reasoned. "But, again, how many of the highways in Colorado can be built for a 1,000-year flood?"[68] Fifteen days after the Council's declaration to rebuild, district engineer

Dwight Bower submitted an application to the Federal Highway Administration for $14.8 million, with a proposal to start reconstruction by December 1976 on the Big Thompson Canyon route.[69] The highway project would be completed in two and a half years, by May 1979, with no work being done over the months of June through September each year to allow unrestricted access during the busy tourist season.[70]

Engineering plans reflected the cultural persistence of Vail and geophysical agency. The project overhauled the road to withstand a hundred-year flood by including "extensive retaining walls" through the Narrows. These concrete-and-steel barriers would keep vacationing cars well above high water, but they also channelized the Big Thompson River. Throughout the rest of the canyon, construction design also entailed "heavy riprap slope protection" in places where the river and road intermingled. Although these blankets of stone and rock prevented the erosion of highway infrastructure, they further heightened stream velocities within the Big Thompson River. The very hydrological impacts that contributed to flooding risk, which the BTRPC hoped to elude by techno-fixes, were the same ones that ended up staring council officials in the face.[71]



Figures 3.6. Engineering plans for the reconstruction of U.S. Highway 34 in the Narrows of the Big Thompson Canyon. Courtesy of Records of Wright Water Engineers, Inc., Water Resources Archive, Colorado State University Libraries.

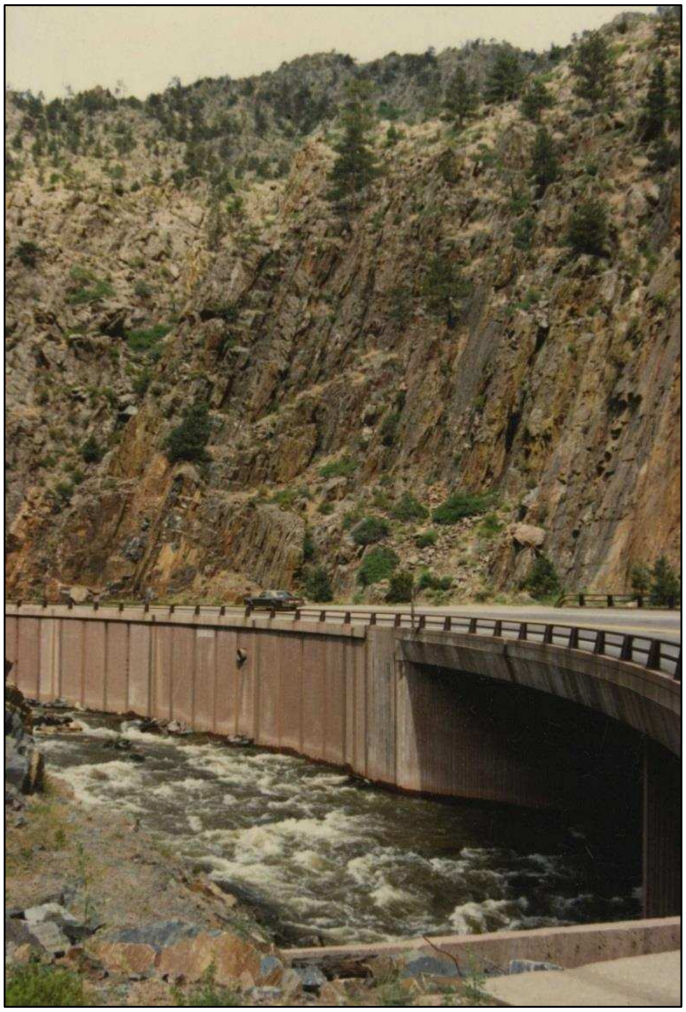


Figure 3.7. A circa-1980 photograph of U.S. Highway 34 rebuilt at the Narrows of the Big Thompson Canyon. Courtesy of the Fort Collins Museum of Discovery Archives.

The Council, ultimately, was swept up by the momentum of U.S. Highway 34. The potential for future canyon inundations undeniably troubled government officials and environmentalists alike. In their minds, highway infrastructure and giants floods coincided for a reason. But an informal alliance of tourist industries, canyon residents, and federal legislation provided enough cultural thrust to deter alternative routing. Attentive only to economic vitality or individual liberty, tourism enterprises and riverine occupants disregarded the hydrological indications to slow down.[72] An expeditious recovery displeased more than just civil servants and green activists, however. On October 26, 1976, Helen Jean Wylie, who lost her parents in the deluge, published an emotionally-driven criticism about the BTRPC's decision in two regional newspapers. "It seems more important to restore Highway 34 to the people of Colorado," Wylie stated, "even if it must be built upon our dead."[73] Over the subsequent year and a half, floodplain zoning would become the next casualty of the Great Acceleration.

*Natural Limits or Natural Rights?*

By spring of 1977, canyon inhabitants thoroughly despised floodplain delineations. Phyllis Hershman, a member of the Big Thompson Action Group, wrote a poem to vent her frustrations about proposed limitations on residential development. Penned to the tune of the classic western song, "Home on the Range," her composition epitomized most opinions from permanent and seasonal residents in this canyon association. Reg Keirnes, a representative of both the advocacy group and the BTRPC, read the prose at a local dinner meeting:

> Oh… Give us a home
> Where no bureaucrats roam
> And flood zoning may soon fade away.
> Where never a word
> B' Alternative is heard
> And 'Districts' are not needed today.[74]

References made in Hershman's poem reveal several points of contention that arose during disaster recovery. As a stipulation for rebuilding U.S. 34, the Federal Insurance Administration and Colorado Land Use Commission mandated "zoning" to protect against future damages inflicted by a hundred-year flood. Similar to highway construction, the BTRPC examined five land-use plans for the canyon, ranging from highly unregulated to very restrictive access. Government "bureaucrats," most of whom desired safer options for human habitation, wanted to calculate the flooding risks associated with various land-use arrangements. The "B'

Alternative" and other choices down the alphabet perturbed riverine inhabitants, who worried over the possible loss of their vacation homes and business investments. Canyon dwellers protested that floodplain "Districts" might put an end to the momentum of suburban land-tenure that had amassed over the Great Acceleration. Coloradans, in effect, found themselves divided over what possessed a more *natural* right to the canyon landscape: flooding or private property?

Before the BTRPC had to reach a verdict over this question, the Larimer County Commissioners placed a temporary halt on residential and commercial reconstruction in the Big Thompson Canyon.[75] On August 6, 1976, by the request of Governor Lamm, they announced a "six-month moratorium" on any sort of canyon redevelopment. The declaration would allow sufficient time for the state government to conduct floodplain studies that would inform appropriate zoning regulations.[76] The BTRPC hired an engineering firm, Gingery & Associates of Denver, to plot flooded areas on canyon diagrams by using statistical and observational data. With this floodplain mapping, the Council hoped to ensure "that building requests will be carefully scrutinized before permission is granted or denied."[77] The county government, besides its obligation to zone, would also "provide for full consideration of private property rights under the law."[78] While floodplain studies were underway, the BTRPC turned its attention to assessing the range of potential land-use patterns within the canyon.

The BTRPC, in consultation with federal, state, and county entities, settled on five possible arrangements for the canyon landscape, categorizing them by the five initial letters of the alphabet. The "A" Alternative, or "Status Quo," would require a "return to pre-flood use patterns, as zoning and floodplain regulations permit," in order to "accommodate private interests (landowners and commercial)." The "B" Alternative, or "Transportation Corridor," would exclusively provide "direct, east to west scenic access" to Rocky Mountain National Park via U.S. 34 in order to sustain “driving for pleasure as a popular and well established recreational activity.” The “C” Alternative, or “Recreation Nodes,” would feature “concentrated areas of open space,” which sought to facilitate “public uses combined with restored and new private interests.” The “D” Alternative, or “Linear Park,” would entail “both concentrated and dispersed recreational [space]…with corridors between them,” leaning towards “expanded public use.” And lastly, the “E” Alternative, or “Public Park,” would result in “public ownership of skyline to skyline,” incorporating the land as national forest or national park into the U.S. Forest Service or National Park Service, respectively.[79] From these choices, the BTRPC deliberations centered on two questions: “What rebuilding or new building should be allowed?” and “What land should be acquired for a park or other public use to preclude development or businesses in that area?”[80]

The tension between natural rights—invoked mostly by canyon residents and some of their government representatives—and natural limits—imposed by the deluge—emerged from opinions about post-flood recovery. Coloradans who appealed to individual property rights in the canyon, even if they were not fully aware of it, rooted their claims upon the historical basis of the Declaration of Independence and U.S. Constitution. These founding documents, in turn, were entrenched in British philosopher John Locke’s idea about the “state of nature.”[81] For instance, Commissioner Warren Wolaver called upon the self-preservation of life, liberty, and property in order to rebuke potential zoning. “By imposing restrictions, we’re confiscating people’s lives, and that’s immoral,” remarked Wolaver. “It’s more immoral than not imposing restrictions and getting a bunch more people killed.”[82] Wayne Wear, a canyon inhabitant, justified rebuilding near the Big Thompson River in natural law. “I own the land,” Wear stressed, “I should be able to live on it within the limits of the law without having to be caught up in the middle of bureaucrats fighting and squabbling."[83] For Wolaver and Wear, the right to private property was fundamental and absolute.

In contrast, Coloradans who argued for limitations to certain land-use practices rooted their assertions in nature itself. One engineering study, for example, called attention to an irony. The 1977 report indicated that "the scenic nature of the canyon has historically attracted growth and development; while specific areas subject to flooding, landslides, rockfalls or unstable slope conditions…impose physical constraints on…certain land uses."[84] Ken Wright, the BTRPC chair, offers another model illustration. "Nature has a prescriptive easement along the valley bottom which it uses at regular intervals for transporting floodwaters," Wright averred. "It does not respect the works of man imprudently placed within this prescriptive easement nor does it understand political decisions to narrow [the] floodway, or floodplains."[85] By tracing the underpinnings of these two positions, it becomes apparent that natural rights were more of a cultural construction while natural limits were more of a material reality. The Big Thompson River had delivered floods that had shaped the canyon since the Pleistocene epoch while the momentum from suburbia had only remade it over the Great Acceleration.

On December 22, 1976, Gingery & Associates presented the BTRPC with preliminary floodplain maps for public review. In the report, the engineering firm utilized "water surface elevations and profiles" in order to "estimate the peak discharges for the 10-, 50-, 100- and 500-year recurrence interval floods on the Big Thompson River." The corporation estimated the peak discharge for a 100-year flood in the Big Thompson Canyon to be 16,900 CFS at the Narrows, or roughly one-half the actual climax stage of the 1976 deluge. The study also determined that "most of the canyon bottom would be inundated during a 100-year flood event." The company engineers, utilizing statistical models, based these flood frequencies on streamflow data from 655 gaging stations along Colorado's Front Range over the previous fifty years.[86] In retrospect, the Great Acceleration had destabilized the validity of traditional calculations in flooding risk. One scholar has pointed out that most hydrological analyses, until recently, rested on the assumption of a stationary climate.[87] The Gingery study likely ignored atmospheric trends because, like other studies, it assumed that major environmental changes only took place over thousands of years.[88] The Great Acceleration proved otherwise. The rapid increase in anthropogenic warning and extreme events on the global scale undermined flooding probabilities on the local scale.[89]

Over the ensuing months, the BTRPC hosted frequent public meetings to seek feedback from canyon residents and other Coloradans about zoning regulations. In an opinion survey of 340 riverine inhabitants, fifty-three percent indicated that they would not sell their homes to the government under any circumstances whatsoever. Another thirty-one percent specified that they would consider selling their houses, but only if they could secure pre-flood values. After the inundation, properties within the Big Thompson Canyon had depreciated thirty to sixty percent in market value.[90] About one-hundred persons who attended a January 1977 hearing were undivided about their opposition to regulation, especially since the compensation rate for their properties was unknown. Some argued that if the government took away their natural right to property through floodplain zoning, then they must be justly compensated at pre-flood prices for their homes or businesses.[91] The Environmental Quality Commission suggested that the BTRPC look into financial aid through the Bureau of Outdoor Recreation (BOR) to purchase canyon properties as an open space corridor and recreational trail. James Disney, director of this environmental group, mentioned that the federal agency had previously spent $13 million on land acquisition after a 1972 flood in Rapid City, South Dakota.[92] The Council agreed to explore funding opportunities for buying out canyon properties if people could not rebuild.[93]

On February 1, 1977, the Larimer County Commissioners—who consisted of William Lopez, along with recently-elected officials, Nona Thayer and David Weitzel—formally adopted floodplain-zoning measures. The decision to approve a new county ordinance came after a two-hour public session in which canyon residents expressed their discontent. One attendee, for example, stated that floodplain regulations violated natural law and were “just one more step [in] taking away citizens’ rights.” Another participant used Cold War red-baiting to get her point across. “If you approve the zoning, this is what the Socialists and Communists do,” she stated. “It’s pouring salt on the wound.”[94] It was estimated that seventy to eighty homes could not be rebuilt in the canyon; and some citizens agreed with the verdict.[95] Ray Drake, a Loveland resident and disaster volunteer, backed the county resolution. “I saw the grief and death and the destruction first hand. I’d like to limit my sympathy to these victims and no more,” Drake explained. “We do know the consequences of no adoption. That’s another tragedy. There will be another flood, ladies and gentlemen. The question is when it will strike.”[96]

Special conditions related to floodplain zoning, though, enabled government officials to circumvent restrictions and sustain the momentum of suburban land-tenure. The Gingery report had outlined two areas within the Big Thompson Canyon: “Under the flood hazard concept, the area of the flood plain is divided into a high hazard zone and a low hazard zone.”[97] The BTRPC hired another engineering firm, the Toups Corporation of Loveland, to revise the floodplain mapping, establish two districts based on the flood hazard concept, and propose development schemes. The “floodway” district would be demarcated as “those portions of the flood plain which are required for the reasonable passage and conveyance of the 100-year return frequency flood.” In this higher risk zone, no new building would take place for any structure more than fifty percent damaged (structures with less than fifty percent could be rebuilt, however). The “flood fringe” district would be defined simply as “the portion of the flood plain inundated by the 100-year return frequency flood not within the floodway.” In this lower risk zone, new construction would be allowed for any structure built with reinforced walls, watertight doors and windows, and other measures that adequately “flood-proofed” the building.[98] To be clear, the entire canyon would be inundated if another hundred-year flood were to occur; and yet the momentum of suburbia and vacationland strengthened a return to the status quo.

As the Toups Corporation finalized zoning maps to be submitted to the Colorado Land Use Commission, political pressure mounted to narrow floodplain delineations.[99] In June 1977, and again in August, Reg Keirnes and the Big Thompson Action Group threatened the BTRPC with the possibility of a class-action lawsuit to test the constitutionality of floodplain zoning and building restrictions.[100] One canyon inhabitant opined that “even with the floodplain study, let the individual judge if they want to return to their past location.”[101] To amplify the issue, Robert Schelling, a pastor who directed Interfaith Task Force in assisting canyon survivors, proposed that the floodway district was twenty-five percent larger than “normal requirements.”[102] When the Toups Corporation published their final report in September, the LCC yielded to the momentum of the Great Acceleration.[103] Commissioner David Weitzel favored minimum restrictive zoning since, in his opinion, valuable land would be “wasted” if the area designated was too large.[104] In October, the county government, to appease the demands of canyon residents, sanctioned the newly-reconfigured floodway and flood fringe districts. The decision meant that only ten percent of all structures within the Big Thompson Canyon could not be reconstructed under the new floodplain regulations.[105]

After the two-fold delineations, the BTRPC addressed the purchase of canyon properties in the floodway district which could not be rebuilt. The group estimated that a land acquisition program would require approximately $2.5 million. Using earlier advice from environmentalists, the Council decided to tap into the BOR's Land and Water Conservation Fund for monetary support. The BTRPC applied for $1,265,000 in federal assets to be matched by the state and local governments. Meanwhile, Congressmen Gary Hart, Floyd Haskell, and James Johnson, all from Colorado, secured approval from the national legislature to make a temporary exception for buying out canyon homes and businesses, allowing federal dollars to be spent at pre-flood values instead of current market prices. With funds approved, the county government acquired twenty-four parcels and turned the 156 acres into turned into a recreational park.[106] The deal amounted to the public subsidization of private loss. The land bought as open space made up only thirteen percent of the 1,195 total acres that existed as residential and commercial areas in the Big Thompson Canyon.[107] To be sure, economic barriers, in effect, would uphold more floodplain zoning as property owners could not afford to rebuild. But in a clash between natural limits and natural rights, the latter mostly won out.

* * *

The 1976 Big Thompson Flood temporarily destabilized the prevailing order. The torrent, in other words, held the potential to slow things down. Coloradans had vastly transformed the canyon to support fundamental elements of the Great Acceleration. The succession of highway construction, automobile-oriented tourism, and suburban development rapidly modified the landscape and climate. When an intense rainstorm arrived, further entangling cars and cabins, trees and trailers, bodies and boulders, human and nonhuman nature collided amidst the floodwaters of a hybrid inundation. In reaction, the BTRPC committed nearly $58 million to disaster recovery through various governmental entities. The financial aid included everything from delivering short-term assistance for flood survivors, to rebuilding U.S. Highway 34 in the canyon, to procuring damaged properties in the floodway.[108] For the most part, these political decisions spurred on a swift return to nearly pre-flood conditions. The energy abundance from fossil fuels perhaps sustained ideas that geophysical agency could again reshape the canyon to anthropocentric ends. As it turned out, the momentum from the Great Acceleration was too much to resist.

Some Coloradans nonetheless lamented the consequences of failing to choose alternative paths. "It bothers me," a local columnist declared, "that new homes are now being constructed on foundations of homes swept away by the flood. New shops and motels are rising beside the buildings that have water marks to the roof and shin[g]les still hanging awry"[109] Governor Richard Lamm concurred. "I'm not at all sure we've learned the lesson of the Big Thompson," Lamm remarked. "These things are too easily removed from our minds."[110] In the early stages of the recovery process, Commissioner William Lopez forewarned citizens about the dangers of quick redevelopment within the Big Thompson Canyon, or in other mountain routes along Colorado's Front Range. Lopez commented, "I worry that some of the plans we see today for buildings and roads may become man's handmade death traps 20 or 30 years down the road."[111]

## NOTES

[1] For general sentiment, see McComb, *Big Thompson*, 3-13. For concert reference, see Naomi Yager, "Naomi Yager," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 151. For Olympics, see "Montreal 1976," International Olympic Committee, http://www.olympic.org/montreal-1976-summer-olympics (accessed on 17 September 2015). For quote, see Alice and Bob Gifford, "Alice and Bob Gifford," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 101.

[2] Gary Haxton, interview by David McComb, 24 August 1976, Folder 4, Box 1, David McComb Big Thompson Flood Collection, Water Resources Archive, Colorado State University, Fort Collins, CO (hereafter cited as McComb Collection); McComb, *Big Thompson*, 29. For the idea of "hybridity," see Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999), 9, 44-52.

[3] For the Big Thompson Flood as natural disaster, see McComb, *Big Thompson*.

[4] For scholarly works that have shaped my understanding of flooding, see Stéphane Castonguay, "The Production of Flood as Natural Catastrophe: Extreme Events and the Construction of Vulnerability in the Drainage Basin of the St. Francis River (Quebec), Mid-nineteenth to Mid-twentieth Century," *Environmental History* 12 (October 2007): 820-44; Jared Orsi, *Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles* (Los Angeles: University of California Press, 2004); Karen M. O'Neill, *Rivers by Design: State Power and the Origins of U.S. Flood Control* (Durham, NC: Duke University Press, 2006); Mark Carey, *In the Shadow of Melting Glaciers: Climate Change and Andean Society* (New York: Oxford University Press, 2010); Fabio De Castro, "From Myths to Rules: The Evolution of Local Management in the Amazonian Floodplain," *Environment and History* 8 (2002): 197-216; Georgina H. Endfield, Isabel Fernández Tejedo, Sarah L. O'Hara, "Conflict and Cooperation: Water, Floods, and Social Response in Colonial Guanajuato Mexico," *Environmental History* 9 (April 2004): 221-47; David A. Biggs, *Quagmire: Nation-building and Nature in the Mekong Delta* (Seattle: University of Washington Press, 2010); Heather J. Hoag, *Developing the Rivers of East and West Africa: An Environmental History* (New York: Bloomsbury Press, 2013); Emanuela Guidoboni, "Human Factors, Extreme Events and Floods in the Lower Po Plain (Northern Italy) in the 16th Century," *Environment and History* 4 (1998): 279-308; Mark Cioc, *The Rhine: An Eco-biography, 1815-2000* (Seattle: University of Washington Press, 2002); David Blackbourn, *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany* (New York: W.W. Norton & Company, 2006); Ted Steinberg, *Acts of God: An Unnatural History of Natural Disasters* (New York: Oxford University Press, 2000).

[5] For the concept of "momentum" in highly-complex technological systems, see Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983), 15-17, 140-174; Thomas P. Hughes, *Human-Built World: How to Think about Technology and Culture* (Chicago: University of Chicago Press, 2004), 79-109; and Thomas Parke Hughes, "Technological Momentum in History: Hydrogenation in Germany, 1898-1933," *Past & Present* 44 (August 1969): 106-32.

[6] U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *Big Thompson Flash Flood of July 31 – August 1, 1976* (Rockville, Maryland: Government Printing Office, 1976), 33; "Heavy Moisture Level Fueled Canyon Storm," *Boulder Daily Camera*, 2 August 1976, Folder 3, Box 3, Records of Wright Water Engineers, Inc., Water Resources Archive, Colorado State University, Fort Collins, CO (hereafter cited as WWE Records).

[7] Harold Tregent, "Tregent Family," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 38.

[8] Robert A. Maddox et al., "Meteorological Aspects of the Big Thompson Flash Flood of 31 July 1976," *NOAA Technical Report ERL 388-APCL 41* (July 1977): 1-83; U.S Department of Commerce, National Oceanic and Atmospheric Administration, *Big Thompson Flash Flood of July 31 – August 1, 1976*, 1-3, 27-28; "Weather was right for floods," *Fort Collins Coloradoan*, 2 August 1976, special edition, Box 8, McComb Collection.

[9] Terry Sandoval and Connie Hays, "Terry Sandoval and Connie Hays," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 30-33.

[10] Jake Henshaw, "The Big Thompson Flood – a Night of Tragedy," *Loveland Daily Herald-Reporter*, 7-8 August 1976, Box 8, McComb Collection.

[11] Robert D. Jarrett and John E. Costa, "1976 Big Thompson Flood, Colorado – Thirty Years Later," U.S. Geological Survey Fact Sheet, July 2006, http://pubs.usgs.gov/fs/2006/3095/pdf/FS06-3095_508.pdf (accessed 12 April 2015).

[12] Linda Burleigh, "'No One Know What Was Coming Down,''" *Loveland Daily Reporter-Herald*, 10 August 1976, Box 8, McComb Collection.

[13] Kenneth R. Wright, *Big Thompson Flood Disaster: Final Report to the Governor of Colorado* (Denver, CO: Wright-McLaughlin Engineers, 1977), I-5, Folder 21, Box 3, McComb Collection; D. B. Simons et al., *Flood of 31 July 1976 in Big Thompson Canyon, Colorado* (Washington, D.C.: National Academy of Sciences, 1978), 27-72, Folder 23, Box 52, Papers of Daryl B. Simons, Water Resources Archive, Colorado State University, Fort Collins, CO; "Big Thompson Canyon: July 31 – Aug. 1, 1976," National Center for Atmospheric Research, http://www.assessment.ucar.edu/flood/ flood_summaries/07_31_1976.html#data (accessed on 11 April 2015); "Ashes To Be Spread in Canyon," *Loveland Daily Reporter-Herald*, 5 August 1976, Box 8, McComb Collection.

[14] Jay Bouton, "Guardsman: 'They Won't Fall All the Bodies for Months,'" *Loveland Daily Reporter-Herald*, 3 August 1976, Box 8, McComb Collection.

[15] Dorothy Ferguson, interview by David McComb, 21 August 1976, Folder 12, Box 1, McComb Collection.

[16] Jake Henshaw, "The Big Thompson flood – a night of tragedy," *Fort Collins Coloradoan*, 2 August 1976, special edition, Box 8, McComb Collection.

[17] "Flood Silences Friendly Call," *Denver Post*, 3 August 1976, Box 8, McComb Collection.

[18] Al and Vena Winslow, "Winslow Family, Rabbit Gulch Area," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 77-78.

[19] Jarrett and Costa, "1976 Big Thompson Flood, Colorado – Thirty Years Later;" "Big Thompson Canyon, July 31 – Aug. 1, 1976," National Center for Atmospheric Research, http://www.assessment.ucar.edu/flood/flood_summaries/07_31_1976.html (accessed on 24 September 2015).

[20] Virginia and Bill Shannon, "Shannon Family," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 78-79.

[21] "Flood Victims Aided by All Donations," *Loveland Daily Reporter-Herald*, 25 August 1976, Folder 1, Box 3, WWE Records; Bill Myers, "July 31 Storm Aid: Parts of 3 Counties Get Disaster Status," *Denver Post*, 20 August 1976, Folder 1, Box 3, WWE Records; McComb, *Big Thompson*, 45-59.

[22] Jack Olsen, Jr., "56 Known Dead in Flood; Hundreds Trapped," *Rocky Mountain News*, 2 August 1976, Folder 3, Box 3, WWE Records.

[23] H. Peter Metzger, "Key to life, death may be 60 seconds," *Denver Post*, 11 August 1976, Folder 1, Box 3, WWE Records.

[24] Bob Ewegen and Bill Myers, "Some, Miraculously, Alive; For Others – Terror, Death," *Denver Post*, 2 August 1976, Box 8, McComb Collection.

[25] Carol Green, "A Futile Search … An Anguished Vigil," *Denver Post*, 8 August 1976, Box 8, McComb Collection.

[26] Most accounts claim 139 people dead and five missing for a likely total of 144 killed by the flood. However, a missing person assumed to be dead was recently found alive, lowering the total to 143 victims. See newspaper article: "Man Presumed Dead in Big Thompson flood is alive," *Aspen Times*, 2 August 2008, http://www.aspentimes.com/article/20080802/NEWS/69066146 (accessed on 13 April 2015).

[27] Gay Cook, "Big Thompson Camping Okay Alarms Land Use Unit," *Denver Post*, 25 May 1977, Folder 13, Box 1, WWE Records.

[28] Kenneth R. Wright, *Big Thompson Flood Disaster*, I-7-I-8, Folder 21, Box 3, WWE Records.

[29] For examples, see Glen Prosser, "Lamm Pleased with Efforts on New Road," *Loveland Daily Reporter-Herald*, 12 August 1976, Box 8, McComb Collection; Gay Cook, "Big Thompson Camping Okay Alarms Land Use Unit," *Denver Post*, 25 May 1977, Folder 13, Box 1, WWE Records; and "Learn from Flood, Look at Highway Alternatives," *Denver Post*, 16 August 1976, Folder 1, Box 3, WWE Records.

[30] Ken Wright, Memorandum to Governor Lamm, 8 July 1977, Folder 19, Box 1, WWE Records.

[31] Robert D. Jarrett and John E. Costa, *Evaluation of the Flood Hydrology in the Colorado Front Range Using Precipitation, Streamflow, and Paleoflood Data for the Big Thompson River Basin* (Denver, CO: U.S. Geological Survey, 1988), 28-30.

[32] Charles A. Perry, "Significant Floods in the United States During the 20th Century—USGS Measures a Century of Floods," U.S. Geological Survey Fact Sheet, March 2000, http://pubs.usgs.gov/fs/2000/0024/report.pdf (accessed on 12 April 2015).

[33] D. Guha-Sapir, R. Below, and Ph. Hoyois, "EM-DAT: International Disaster Database," Université Catholique de Louvain, Brussels, Belgium, http://www.emdat.be/disaster_trends/index.html (accessed on 12 April 2015).

[34] Mario Molina et al. *What We Know: The Reality, Risks, and Response to Climate Change* (Washington, D.C.: American Association for the Advancement of Science, 2014), 2, http://whatweknow.aaas.org/wp-content/uploads/2014/07/whatweknow_website.pdf (accessed on 23 September 2015).

[35] Ibid.

[36] Will Steffen et al., *Global Change and the Earth System: A Planet under Pressure* (New York: Springer, 2005), 133.

[37] Jane Earle, "Lamm Says Estes Park Tourism 'Alive and Well,'" *Denver Post*, 12 August 1976, Folder 1, Box 3, WWE Records. Although Rogers inflated his numbers, tourism did experience a temporary post-flood, economic decline. See, for example, "Thompson Flood affected tourism," *Triangle Review*, 23 March 1977, Box 8, McComb Collection; and Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 1 (Loveland, CO: Toups Corporation, 1977), 105-06, Folder 19, Box 3, WWE Records.

[38] David Espo, "Thompson Tourism Officials Working to Rescue Industry," *Fort Collins Coloradoan*, 9 August 1976, Box 8, McComb Collection.

[39] Jane Earle, "Lamm Says Estes Park Tourism 'Alive and Well,'" *Denver Post*, 12 August 1976, Folder 1, Box 3, WWE Records.

[40] Emphasis added by author. Corky Rogers, interview by David McComb, 8 September 1976, Folder 7, Box 3, McComb Collection.

[41] James Mahoney defines "path dependence" as "historical sequences in which contingent events set into motion institutional patterns or event chains that have deterministic properties." Naomi Klein defines the "shock doctrine" as when crises are the only opportunities for actual change. Klein argues that crises, in most instances, provide moments for neo-liberal takeover or "disaster capitalism." My understanding views this disaster as a continuation of a capitalistic foothold. For the ideas that inform this paragraph, see James Mahoney, "Path dependence in historical sociology," *Theory and Society* 29 (August 2000): 507-11; Naomi Klein, *The Shock Doctrine: The Rise of Disaster Capitalism* (New York: Metropolitan Books, 2007), 6-7; Martin V. Melosi, "Path Dependence and Urban History: Is a Marriage Possible?" in *Resources of the City: Contributions to an Environmental History of Modern Europe,* eds., Dieter Schott, Bill Luckin, and Genevieve Massard-Guilbaud (Aldershot: Ashgate, 2005), 262-75; Frederick C. Cuny, *Disasters and Development* (New York: Oxford University Press, 1983), 3-20; Hughes, *Networks of Power*, 15-17, 140-174.

[42] Wolaver as quoted in Kenneth R. Wright, *Big Thompson Flood Disaster: Final Report to the Governor of Colorado* (Denver, CO: Wright-McLaughlin Engineers, 1977), III-4, Folder 21, Box 3, McComb Collection.

[43] Commissioner John Michie also chaired the Council. When he lost reelection, however, Michie was removed from the group and William Lopez was installed as co-chair. Ibid., III-4–III-8.

[44] "Big Thompson Report," 19 December 1977, Folder 8, Box 2, WWE Records.

[45] Robert D. Phillips, Letter to Governor Lamm, 4 August 1976, Folder 9, Box 3, WWE Records.

[46] "$10 million, year needed to rebuild road," *Rocky Mountain News*, 3 August 1976, Folder 3, Box 3, WWE Records.

[47] Willard R. Quirk, Minutes of Big Thompson Advisory Committee, 18 January 1977, Folder 5, Box 1, WWE Records

[48] "Misgivings Line U.S. 34 Route," *Denver Post*, 3 September 1976, Folder 9, Box 3, WWE Records.

[49] "Alternative Analysis Overview for the Location of U.S. 34, Estes Park to Loveland," n.d., Folder 9, Box 3, WWE Records; "Scenario IV – To Construct a New Highway in Canyon Bottom Using Modern Engineering and Planning," n.d., Folder 9, Box 3, WWE Records; Jeanette Chavez, "Thompson Road Study due Sept. 1," *Fort Collins Coloradoan*, 23 August 1976, Box 8, McComb Collection; "U.S. Routing Reports Expected," *Greeley Tribune*, 30 August 1976, Folder 1, Box 3, WWE Records.

[50] George Gudauskas, "Larimer County declared disaster areas by President," *Rocky Mountain News*, 3 August 1976, Folder 3, Box 3, WWE Records; Bill Myers, "July 31 Storm Aid: Parts of 3 Counties Get Disaster Status," *Denver Post*, 20 August 1976.

[51] "State Breaks Promise, Confuses Status for Highway 34," *Estes Park Trail-Gazette*, 27 August 1976, Box 8, McComb Collection.

[52] "State Breaks Promise, Confuses Status for Highway 34," *Estes Park Trail-Gazette,* 27 August 1976, Box 8, McComb Collection; "U.S. 34 Funding Choices Explained by Rep. Howard," *Estes Park Trail-Gazette,* 20 August 1976, Box 8, McComb Collection; Samuel P. Hays, *Health, Beauty, and Permanence: Environmental Politics in the United States, 1955-1985* (New York: Cambridge University Press, 1987), 275-81.

[53] "Lamm Hints June U.S. 34 Opening," *Estes Park Trail-Gazette*, 13 August 1976, Box 8, McComb Collection.

[54] Douglas Kreutz, "Flood Victims Want New Road on Old Bed," *Rocky Mountain News*, 1 September 1976, Folder 27, Box 2, WWE Records.

[55] Corky Rogers, "Resolution from Estes Park Chamber of Commerce," n.d., Folder 9, Box 3, WWE Records; "Don't Tamper with Route, Estes Park Chamber Says," *Estes Park Trail-Gazette*, 27 August 1976, Box 8, McComb Collection.

[56] R.L. Anderson, "Policy Position: Restoration of U.S. Highway 34 Big Thompson Canyon," 8 September 1976, Folder 9, Box 3, WWE Records.

[57] For similar positions, see S.G. Ferdinandtsen, "Position Paper from the Estes Park Accommodations Association regarding Replacement of U.S. Highway 34," n.d., Folder 9, Box 3, WWE Records; Larimer-Weld Regional Council of Governments, "Statement of Objectives to be Considered in Determining the Disposition of U.S. Highway 34 between Loveland and Estes Park," 30 August 1976, Folder 9, Box 3, WWE Records; Donald H. Lickfett, Letter to Governor Richard Lamm, 26 August 1976, Folder 9, Box 3, WWE Records.

[58] Kenneth Wright, telephone call with notes to Lee White, 21 September 1976, Folder 19, Box 1, WWE Records.

[59] Kenneth R. Wright, Memorandum to Richard Lamm, 11 November 1976, Folder 20, Box 1, WWE Records.

[60] Ken Wright, Memorandum to Lee White and Jim Monaghan, 22 August 1976, Folder 9, Box 3, WWE Records.

[61] Jay Bouton, "Canyon Residents Want U.S. 34 'Like It Was,'" *Loveland Daily Reporter-Herald,* 17 August 1976, Box 8, McComb Collection; Dean Lehman, "Canyon of Death Fights Quick Return to Norm," *Loveland Daily Reporter-Herald,* 4 August 1976, Box 8, McComb Collection.

[62] Big Thompson Advisory Committee, Memorandum to Colorado State Highway Commission, 1 September 1976, Folder 9, Box 3, WWE Records; Jeanette Chavez, "Panel Urges U.S. 34 Rebuilt in Old Route," *Fort Collins Coloradoan,* 1 September 1976, Box 8, McComb

Collection; Mike Peters, "Rebuilding U.S. 34 in Canyon Urged," *Greeley Tribune*, 1 September 1976, Folder 26, Box 2, WWE Records.

[63] Jeanette Chavez, "Panel Urges U.S. 34 Rebuilt in Old Route," *Fort Collins Coloradoan*, 1 September 1976, Box 8, McComb Collection.

[64] Hays, *Health, Beauty, and Permanence*, 1-12, 527-43; Phillip Shabecoff, *A Fierce Green Fire: The American Environmental Movement*, Revised Edition (Washington, D.C.: Island Press, 2003), 121-40; David Stradling, ed., *The Environmental Movement, 1968-1972* (Seattle: University of Washington Press, 2012), 3-9; James Morton Turner, *The Promise of Wilderness: American Environmental Politics since 1964* (Seattle: University of Washington Press, 2012), 1-42; Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Washington, D.C.: Island Press, 2005), 43-160; Hal K. Rothman, *The Greening of a Nation?: Environmentalism in the United States since 1945* (New York: Harcourt Brace, 1998), 83-133.

[65] Mary Taylor, Letter to Richard Lamm, 14 September 1976, Folder 20, Box 1, WWE Records; "Lamm Advised to Heed Big Thompson's Warning," *Denver Post*, 19 September 1976, Folder 27, Box 2, WWE Records.

[66] James Disney, Letter to Jack Kinstlinger, 22 September 1976, Folder 9, Box 3, WWE Records.

[67] Phil Gruis, "Counterpoint – Nature's Way," *Boulder Daily Camera*, 8 August 1976, Folder 2, Box 3, WWE Records; Bob Saile, "We Must Respect Mother Nature," *Denver Post*, 8 August 1976, Folder 2, Box 3, WWE Records.

[68] Glenn Prosser, "Lamm Pleased With Efforts on New Road," *Loveland Daily-Reporter Herald*, 12 August 1976, Box 8, McComb Collection.

[69] Jeanette Chavez, "U.S. 34 Environmental Report Gets Tentative OK," *Fort Collins Coloradoan*, 15 September 1976, Box 8, McComb Collection.

[70] "Timetable for Construction – U.S. 34 – Big Thompson Canyon," n.d., Folder 5, Box 1, WWE Records.

[71] Jeanette Chavez, "U.S. 34 Environmental Report Gets Tentative OK," *Fort Collins Coloradoan*, 15 September 1976, Box 8, McComb Collection; Jane Cracraft, "U.S. 34 Rebuilding Backed," Denver Post, 1 September 1976, Folder 27, Box 2, WWE Records; E. D'Appolonia Consulting Engineers (EDCE), Inc., *Illustration of Steel Soldier Piles With Precast Concrete Panels*, Figure 9, Colorado Department of Highways, 13 July 1977, Folder 9, Box 3, WWE Records; E. D'Appolonia Consulting Engineers (EDCE), Inc., *Illustration of Dumped and Keyed Riprap*, Figure 19, Colorado Department of Highways, 13 July 1977, Folder 9, Box 3, WWE Records.

[72] Frank Uekotter, "Farming and Not Knowing: Agnotology Meets Environmental History," in *New Natures: Joining Environmental History with Science and Technology Studies*, eds., Dolly Jørgensen, Finn Arne Jørgensen, and Sara B. Pritchard (Pittsburgh, PA: University of Pittsburgh Press, 2013), 37-50; Naomi Oreskes and Erik M. Conway, "Challenging Knowledge: How Climate Science Became a Victim of the Cold War," in *Agnotology: The Making and Unmaking of Ignorance*, eds., Robert Proctor and Londa Schiebinger (Stanford, CA: Stanford University Press, 2008), 55-89.

[73] As quoted in *Denver Post*, 26 October 1976, and *Fort Collins Coloradoan*, 26 October 1976, in McComb, *Big Thompson*, 64.

[74] "The Next Two Years," in *Reflections on the River: The Big Thompson Canyon Flood*, ed., Sharlynn Wamsley (Denver: Drake Club Press, 2001), 15.

[75] Marc Crampton, "Building Moratorium Discussed Until Flood Plain Study Done," *Loveland Daily Reporter-Herald*, 6 August 1976, Box 8, McComb Collection.

[76] Fred Brown, "Construction Ban Ordered in Canyon," *Denver Post*, 7 August 1976, Box 8, McComb Collection.

[77] Stephanie Brown, "Zoning Changes Likely in Big Thompson Canyon," *Fort Collins Coloradoan*, 4 August 1976, Box 8, McComb Collection.

[78]"Outline of Objectives" in Ken Wright, Memorandum to Governor Lamm and James Monaghan, 23 August 1976, Folder 20, Box 1, WWE Records.

[79] Big Thompson Canyon Recovery Planning, "Recreation Alternatives Study," n.d., Folder 15, Box 1, WWE Records.

[80] Jeanette Chavez, "Floodplain zoning: Are there places people can't live?" *Loveland Daily Reporter-Herald*, 7-8 August 1976, Box 8, McComb Collection.

[81] Mark Fiege, *The Republic of Nature: An Environmental History of the United States* (Seattle: University of Washington Press), 57-99; John Locke, *Second Treatise of Government*, ed. Richard Cox (Wheeling, IL: Harlan Davidson, 1982), 17-31.

[82] "Don't be hypocrites," *Triangle Review*, 24 November 1976, Folder 13, Box 1, WWE Records.

[83] Robert L. Scheier, "Big Thompson revisited one year after the flood," *Fort Collins Coloradoan*, 31 July 1977, Folder 25, Box 2, WWE Records.

[84] Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 3 (Loveland, CO: Toups Corporation, 1977), 2, Folder 19, Box 3, WWE Records.

[85] Kenneth R. Wright, Letter to Edward Murray, 20 May 1977, Folder 10, Box 1, WWE Records.

[86] Gingery Associates, Inc., *Special Flood Plain Information Report – Big Thompson River and Tributaries – Larimer County, Colorado* (Englewood, CO: Gingery Associates, Inc., 1976), 1-2, 10-12, 14, Box 9, Papers of William P. Stanton, Water Resources Archive, Colorado State University Libraries.

[87] J. Rolf Olsen, "Climate Change and Floodplain Management in the United States," *Climatic Change* 76 (June 2006): 407-26.

[88] Gingery Associates, Inc., *Hydrology Study – Big Thompson River and Tributaries – Larimer County above Loveland, Colorado* (Englewood, CO: Gingery Associates, Inc., 1976), 4-12, Folder 22, Box 3, WWE Records; a 1977 report from the U.S. Water Resources Council, which was cited in the Gingery study, stated that "in hydrological analysis it is conventional to assume flood flows are not affected by climatic trends or cycles." For quote, see U.S. Water Resources Council, *Guidelines for Determining Flood Flow Frequency*, Bulletin #17A of the Hydrology Subcommittee (1976; Washington, D.C.: Government Printing Office, 1977), 6; for additional information on statistical modeling, see Jerald F. McCain and Robert D. Jarrett, *Manual for Estimating Flood Characteristics of Natural-Flow Streams in Colorado* (Denver: Colorado Water Conservation Board, 1976), 1-45.

[89] Mark Carey, "Science, Models, and Historians: Toward a Critical Climate History," *Environmental History* 19 (April 2014): 354-64.

[90] Kenneth R. Wright, Memorandum to Larimer County Commissioners, 11 November 1976, Folder 6, Box 1, WWE Records; Willard Quirk and Larimer County Commissioners, Memorandum to Kenneth R. Wright, 12 November 1976, Folder 6, Box 1, WWE Records.

[91] Jeanette Chavez, "Canyon residents oppose floodplain zoning," *Fort Collins Coloradoan*, 27 January 1977, Box 8, McComb Collection; John and Mary Lyne Schewry, "Solution to the Dilemma of Big Thompson Canyon," n.d., Folder 10, Box 1, WWE Records.

[92] Marc Crampton, "Open Space Corridor Discussed," *Loveland Daily Reporter-Herald*, n.d., Box 8, McComb Collection.

[93] "Big Thompson and North Fork Canyons Recommended Outline Plan," n.d., Folder 13, Box 1, WWE Records.

[94] Jeanette Chavez, "Commissioners approve canyon floodplain zoning," *Fort Collins Coloradoan*, 1 February 1977, Box 8, McComb Collection.

[95] Jeanette Chavez, "County begins review of floodplain studies," *Fort Collins Coloradoan*, 22 December 1976, Box 8, McComb Collection.

[96] Jeanette Chavez, "Commissioners approve canyon floodplain zoning," *Fort Collins Coloradoan*, 1 February 1977, Box 8, McComb Collection.

[97] Gingery Associates, Inc., *Special Flood Plain Information Report – Big Thompson River and Tributaries – Larimer County, Colorado* (Englewood, CO: Gingery Associates, Inc., 1976), 15, Box 9, Papers of William P. Stanton, Water Resources Archive, Colorado State University Libraries.

[98] Jeanette Chavez, "County begins review of floodplain studies," *Fort Collins Coloradoan*, 22 December 1976, Box 8, McComb Collection; for floodplain definitions, see "Flood Plain Amendment to the Larimer County Building Code," 1 December 1975, Folder 13, Box 1, WWE Records.

[99] Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 1 (Loveland, CO: Toups Corporation, 1977), Folder 19, Box 3, WWE Records; Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 2 (Loveland, CO: Toups Corporation, 1977), Box 5, WWE Records.

[100] W. Paul Eckman, Memorandum to Big Thompson Canyon Residents, 20 June 1977, Folder 13, Box 1, WWE Records; Don Lawson, "Big T residents call LUC 'paper tiger,'" *Loveland Daily Reporter-Herald*, 2 August 1977, Folder 24, Box 2, WWE Records.

[101] Glen R. Smith, "The problems of rebuilding: Big Thompson a year later," *Straight Creek Journal*, 23 June 1977, Folder 25, Box 2, WWE Records.

[102] "Delays, Indecision Blocking Goals," *Estes Park Trail-Gazette*, 29 July 1977, Folder 25, Box 2, WWE Records.

[103] Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 3 (Loveland, CO: Toups Corporation, 1977), Folder 19, Box 3, WWE Records; Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 4 (Loveland, CO: Toups Corporation, 1977), Box 5, WWE Records.

[104] "Thompson floodway criteria discussed by commissioners," *Fort Collins Coloradoan*, 12 October 1977, Folder 24, Box 2, WWE Records.

[105] "Extent of Canyon Development Goes to Hearing Process," *Estes Park Trail-Gazette*, 8 September 1977, Folder 24, Box 2, WWE Records; Kep Petitt, "Floodway regulations will now be reviewed," 12 October 1977, Folder 24, Box 2, WWE Records; "Thompson floodway criteria discussed by commissioners," *Fort Collins Coloradoan*, 12 October 1977, Folder 24, Box 2, WWE Records; Willard R. Quirk, Minutes of Big Thompson Advisory Committee, 18 October 1977, Folder 5, Box 1, WWE Records; Colorado Land Use Commission, "Resolution of the Colorado Land Use Commission Pertaining to Designation of Matters of State interest in Larimer County, Colorado," 24 June 1977, Folder 5, Box 1, WWE Records.

[106] M. Stephen McMillan, Memorandum to Fred Anderson et al., 1 February 1977, Folder 16, Box 1, WWE Records;  "Big Thompson / North Fork Canyons – Recreation Acquisition Project," n.d., Folder 16, Box 1, WWE Records; "Andrus promises Big T help," *Fort Collins Triangle Review*, 27 October 1977, Folder 17, Box 1, WWE Records; "Portion of Big Thompson to be Turn into Park," 16 December 1977, Folder 24, Box 2, WWE Records.

[107] Toups Corporation, *Big Thompson Recovery Planning Report*, Vol. 5 (Loveland, CO: Toups Corporation, 1977), 20, 23, Folder 20, Box 3, WWE Records

[108] Kenneth R. Wright, *Big Thompson Flood Disaster: Final Report to the Governor of Colorado* (Denver, CO: Wright-McLaughlin Engineers, 1977), IV-10, Folder 21, Box 3, McComb Collection; "Big Thompson Recovery Program – Summary Graph" in Ken Wright, Memorandum to Governor Lamm, 8 July 1977, Folder 19, Box 1, WWE Records.

[109] "'Tragedy: Do we learn?" *Haxtun Herald*, 25 August 1977, Folder 24, Box 2, WWE Records.

[110] Daniel Thomas, "Flood changed victims' lives forever," *Fort Collins Colden Triangle Review*, 3 August 1977, Folder 1, Box 3, WWE Records.

[111] "'Trap' Rebuilding Feared in Canyon," *Denver Post*, 25 August 1976, Folder 1, Box 3, WWE Records.

# CONCLUSION

## REVISITING DISASTER AND SCALE IN THE ANTHROPOCENE

When torrential rain arrived in September 2013, sixty-year-olds Lena and Howard Carman must have felt a case of déjà vu. Some forty years prior, in 1971, the Carmans first opened the Big Thompson Indian Village Gift Shop within the canyon; their business centered on selling Native American handicrafts to motoring tourists. The 1976 deluge, however, interrupted commercial endeavors. Flood damages forced the Carmans to reconstruct three buildings, converting their wooden store into a sturdier, stone structure, so that they could sustain their work within the flood fringe zone. “We never, ever thought that there’d be any water that would get up near the store again,” Howard commented. “We’d done everything we could to channel the water away from us and make sure we’d never see the problem again.”[1]

The Carmans survived the most lethal flood in Colorado’s history only to face hardship once more. In 2013, the Big Thompson River surged through the canyon anew; and in an eerily-similar manner, it ravaged highway, homes, and humans. U.S. 34 disintegrated into chunks and pieces for a price tag of eighty million dollars in repairs. The torrent damaged or destroyed over 130 buildings and it took the lives of two elderly residents of Cedar Cove.[2] For the Carmans, floodwaters wiped out their entire property, including their store and house which contained an estimated one million dollars in jewelry, tapestry, and artwork. Though battered, the Carmans felt relieved to still be alive. “It takes a long time for it to grow back and cover the scars,” Lena remarked. “It will happen. Everyone will move on.”[3] This personal struggle, according to local newspapers, was a story of individual perseverance.[4]

Our culture is saturated with these types of localized narratives. Like a camera lens, the story about the Carmans fixates on particular instances of misfortune in time and space, but the larger developments at play become out-of-focus. The individual is apparent, but the collective obscured. The local clear and visible, but the global blurred and opaque. To be sure, human-interest pieces and narrowly-focused accounts are valuable. They are stories that relate to our sense of people and place. They recognize the dignity of each individual person. And they deliver striking details that often grab our attention. Yet for all compelling aspects, traditional micro-histories tell only part of the story. Hidden from our collective purview are the wider web of connections that made the Carmans' ventures possible in the first place.[5]

Absent are stories about the numerous global forces representative of the Anthropocene's Great Acceleration—highways, automobiles, tourism, atmospheric carbon dioxide, and floods—which, all together, intensified human vulnerability within Colorado's Big Thompson Canyon. During the 1930s, highway engineers merged the biophysical energy from construction workers' bodies with the hydrocarbon energy in oil to build U.S. 34, becoming akin to a geologic force. This auto infrastructure, while facilitating ease of accessibility for the Carmans and their tourist patrons, constricted—as well as channelized—the Big Thompson River. Overall, the modern highway increased the watercourse's destructive power. Tourism businesses then capitalized on the explosion of postwar vacation travel, altering both material and perceptual environments through promotional literature in the process. These idealized spaces, in turn, led to an upsurge in canyon inhabitants and visitors from which the Carmans profited. After the disastrous 1976 inundation, the momentum of the Great Acceleration assisted in returning this canyon landscape to nearly pre-flood conditions. These political decisions allowed the 2013 deluge to again wreak havoc on canyon people and property—the Carmans included. For reporters, scientists, and historians alike, the problem with the story about the Carmans, among other stories in the Anthropocene, is one of disaster and scale.

*Rethinking Disaster*

Disasters such as the 1976 Big Thompson Flood offer powerful counter-narratives to the Promethean vision that technological fixes will always solve ecological problems. Highway engineer Charles Vail, for instance, possessed an unbounded faith that human artifice—road infrastructure in this particular case—would overcome the obstacle of flooding along Colorado's Front Range. But instead of moderating canyon waters, embankments and channel modifications for U.S. Highway 34 led to unintended effects by amplifying the Big Thompson River's force. Vail and the engineers of the Colorado State Highway Department were not unlike James W. Reagan and other technical experts at the Los Angeles County Flood Control District. In the 2004 book, *Hazardous Metropolis*, environmental historian Jared Orsi has recounted how the city of Los Angeles tried to mitigate urban flooding over most of the twentieth century—with only partial success—through technical measures like check dams and catchment basins.[6] Orsi exposed the flawed assumption that "nature was a disorderly but knowable system, which humans could redesign using technology to cause rivers to function in orderly, predictable ways."[7] As for one principal lesson, disasters provide cautionary tales about the hubris of command-and-control engineering.[8]

Technofixes, in both past and present, hold a potent allure because they require little to no societal change. Momentum from the Great Acceleration deterred Coloradans from choosing different highway paths after the 1976 flood, opting to upgrade the Big Thompson Canyon route to "modern engineering standards" instead. In the 2000 monograph, *Acts of God*, environmental historian Ted Steinberg has revealed how American elites have gravitated towards technical prescriptions for environmental disorder because they quickly restore the industrial-capitalist establishment. Steinberg argued that people in power have tended to invoke purely natural or divine forces at work during extreme events, such as flooding, in order to absolve human culpability from these calamitous situations. For example, public discourse about "acts of God" obscured liability in warning efforts during three 1970s flash floods. With a combined death toll of some 450 people, the deluges at Rapid City, South Dakota (1972), Big Thompson Canyon, Colorado (1976), and Johnstown, Pennsylvania (1977), had one thing in common: the National Weather Service possessed advanced meteorological tools but acute personnel shortages. Despite earlier reports about staffing problems, U.S. Congress favored remote forecasting over community education because it cost less. If floods and other "natural" catastrophes were removed from human influence, these lawmakers reasoned, new technologies were most practicable. By naturalizing—thus normalizing and vindicating—disaster, messages of this kind have allowed politicians, policymakers, and business leaders to maintain the status quo.[9]

Technical prescriptions are habitually touted as the only politically- and economically-viable options. Many Coloradans, especially those from Estes Park, believed that reengineering the canyon highway was the only path to restore a tourist economy. But the hidden expenses of redevelopment are often overlooked without historical examination. In the 1998 book, *Ecology of Fear*, writer Mike Davis has scrutinized how federal and state assistance subsidized the swank suburbs of Malibu's wildfire-prone foothills in California. Davis observed that, blaze after blaze, powerful homeowners associations lobbied government officials for the latest fire-suppression technologies, such as an aircraft fleet, to douse potential infernos. And in this way, private needs were generally absorbed by the larger public.[10] The cost of building and rebuilding highway infrastructure in the Big Thompson Canyon buttresses this notion. After both the 1976 and 2013 floods, the Estes Park Chamber of Commerce demanded government intervention. Federal and state entities spent $1.3 million to construct U.S. 34 in the 1930s, $14.8 million to reconstruct it following the 1976 disaster, and $80 million after the 2013 deluge. At least on the surface, these figures simply reflect the price increases over time. When adjusted for inflation, though, the real cost of a reconstructed road has roughly doubled on each occasion.[11] Technofixes always involve questions of power, so it is important to understand who benefits from them, and who does not.

When we recognize that environmental disasters—floods, droughts, wildfires, climate change—are thoroughly imbedded within human actions and decisions, a cognitive shift could occur. Namely, disasters appear *less* like crises in need of better technology and *more* like crises of culture. This cataclysmic reality is what makes the idea of "hybridity," a concept developed by the environmental historian Mark Fiege, so compelling. In the 1999 book, *Irrigated Eden*, Fiege demonstrated how the irrigation networks of southern Idaho were the historical byproducts of human and natural systems. For example, engineered canal ditches often interwove with preexisting stream beds to the point where the artificial and material blurred together.[12] The same notion held true for the Big Thompson Flood of 1976. It became impossible to parse out the effects of roadside technology from mountain geomorphology, suburban domain from rocky terrain, during this torrent. "Humans alter land and water, often destroying much of what is natural and turning the land into an artifact," Fiege has observed. "In turn, nature changes what humans build, often in unanticipated ways; sometimes nature comes back more powerful than before."[13] In the tourist hamlets of the Big Thompson Canyon, human artifice was profoundly entangled with natural phenomena; and because of these hybrid features, flooding on the Big Thompson River came back more powerful than before.

Disasters are by no means confined to North America, but arise from places across the globe. In the 2010 book, *In the Shadow of Melting Glaciers*, environmental historian Mark Carey has examined how global warming-related catastrophes affected the Callejón de Huaylas in Peru. Carey studied how the local communities, government officials, and scientific experts attempted to deal with glacial-melt avalanches and flooding along the Cordillera Blanca of the Andes. The 1941 Huaraz Disaster—instigated by melting ice chunks plunging into Lake Palcacocha, which then triggered an outburst to cascade down the Quilcay River—killed five-thousand people and destroyed nearly one-third of the city. This cataclysmic event was one of a series of glacial-lake outburst floods that roughly corresponded in timing with the "Great Acceleration" spike over the second half of the twentieth century. In attempting to mitigate these disasters, the Peruvian government sponsored glacial-lake draining and built twenty-five "security projects" by the late 1980s. However, Carey indicates that climate change, cultural values, and political economy continued to undermine these technical measures. Flood vulnerability escalated as the number of glacial lakes in the Cordillera Blanca grew due to warming temperatures, as statutes for hazard zoning faltered with an absence of political will or local support, and as national modernization schemes elevated tourism within the Andes. By the 1990s, scientists had connected the melting glaciers to global climate change as economic development continued. Carey's narrative about the Peruvian Andes has demonstrated that the story of Colorado's Big Thompson Canyon was not unique. Disasters are of wide-reaching significance during the Anthropocene.[14]

From a global outlook, a historical pattern starts to emerge: namely that highly-complex, technological systems are bound to fail at times because engineering cannot account for all the contingencies of human society and the material world.[15] At the end of January 1953, spring tides, cyclonic winds, and a low-pressure system over the North Sea brought coastal flooding to the Netherlands and British Isles. Floodwaters peaked almost eleven feet above the average sea level and engulfed run-down coastal barriers due to World War II. Along the eastern coast of England, the inundation breached the engineered defenses in 1,200 areas, which damaged 24,000 properties and killed 307 people. The Netherlands suffered 47,300 damaged buildings and 1,836 persons died as well.[16] Over twenty years later, in August 1975, the typhoon season brought nearly forty inches of rain over three days to the Henan province of central China. Floodwaters breached the Banqiao and Shimantan Dams on the Haui River Basin, surpassing any worst-case scenario of Chinese and Soviet engineers when they designed the hydroelectric flood-control structures in the 1950s, and triggered a series of sixty additional dam failures. The subsequent inundations killed 171,000 people (some scholars estimate more) and dam ruptures swamped the dwellings of 11 million citizens.[17] All these examples uncover folly in the high-modernist belief that technology will always prevent or solve these catastrophes. These historical perspectives on disaster, if anything, ought to cultivate a more humbling view of reality.

With failed technofixes on local scales, disaster narratives should give serious pause to the claims that today's geo-engineering schemes could actually work on a global level. Geo-engineering, also called climate engineering, encompasses a variety of large-scale interventions in order to manipulate the Earth's thermostat. The so-called eco-modernists, which feature scientists like David Keith and Erle Ellis in addition to the "new" environmentalists such as Michael Shellenberger and Ted Nordhaus, advocate for geo-engineering as the principal answer to curb the worst effects of anthropogenic climate change.[18] The eco-modernists support a range of geo-engineering plans: from spraying sulfate particles into the atmosphere in order to redirect heat-inducing sunlight back into space, to fertilizing the oceans in order to promote algae blooms that function as carbon sinks.[19] Through technological means, the eco-modernists believe that humanity can reengineer our world and eventually "uncouple" people from nature. Ellis stated, "We must not see the Anthropocene as a crisis, but as the beginning of a new geological epoch ripe with human-directed opportunity."[20] The 2015 treatise, *An Ecomodernist Manifesto*, has taken an even stronger position: "we write with the conviction that knowledge and technology, applied with wisdom, might allow for a good, or even great, Anthropocene."[21] In many ways, the rhetoric from present geo-engineering proposals echoes the hubris in past attempts at command-and-control engineering.

Eco-modernists are not without critics. In the 2013 work, *Earthmasters*, ethicist Clive Hamilton has warned that geo-engineering presents a "moral hazard" because it reduces the political desire to treat the deep causes of climate change through carbon abatement. Indeed, many of the individuals and entities who deny that human-induced global warming exists are the same ones who promote climate engineering as a favorable route to mitigate this problem. But Hamilton has also cautioned that geo-engineering will likely result in unforeseen consequences.[22] The historians Naomi Oreskes and Erik Conway have treated this latter worry with an intriguing thought-experiment in the 2014 futurist account, *The Collapse of Western Civilization*.[23] Oreskes and Conway have imagined the year 2042 as an international governing body adopts sulfate aerosol injections in response to prolonged heat waves across the Earth. Only four years later, this geo-engineering plan fails when the "solar shield" accidentally halts India's monsoon season—leading the nation into crop failures, mass starvation, and withdrawal of support. Global temperatures spike due to the abrupt termination of this solar-radiation program, which results in the melting of all major ice sheets and the dislocation of world populations from sea-level rise.[24] To avert this possible outcome, if only one of many plausible outcomes, the Anthropocene epoch calls on environmental scholars to engage past, present, and future over scales from local to global. It demands we think more carefully about time and space.

### *Reconsidering Scale*

The challenge of scale has no easy answers. The historians William Cronon and Donald Worster first articulated these issues in the 1980s and early 1990s: the former advocated for local or regional methodologies, while the latter favored a “postnationalist” approach. For Cronon, stories told at micro-levels allowed scholars to show human-environmental relationships in vivid detail that make these connections more tangible to readers. For Worster, the material world that these narratives try to capture on page often transcend the traditional parameters and boundaries established by historians. In a 1999 essay, historian Richard White attempted to reconcile the two positions by arguing that environmental histories should be interpreted on a series of interrelated scales—local, regional, national, and global—because nature functions at all those levels. As an example, White explained that salmon of the Pacific North American West can be examined as individual, local, state, national, and transnational fish: how we understand these creatures depends upon the levels in which they are framed. Scale also matters when considering the 1976 Big Thompson Flood. From a local angle, the inundation was an anomaly. The canyon walls had not witnessed floodwaters of the same magnitude for the last ten thousand years.[25] And yet from a global slant, the deluge was commonplace. Extreme events had become more frequent over the latter half of the twentieth century in part due to rising atmospheric levels of carbon dioxide.[26] Oddity or ordinary, both are contingent upon differing analytical levels; but whatever the case, more layers of scale often equates to a fuller understanding of the past.[27]

If we accept an ecological insight that everything in this world is deeply interconnected, then its central premise should guide our understanding of scale, too. Each analytical level, sociologist Bruno Latour has insisted, "offer[s] points of view on networks that are by nature neither local nor global, but are more or less…connected."[28] In the 1993 book, *We Have Never Been Modern,* Latour explained that an international railroad could be viewed both as a series of local stations and as a global web of transportation. For Latour, the "local" or the "global" has indicated a more or less integrated system.[29] Instead of a local-global binary, in his 2011 work, *Scale*, the geographer Andrew Herod has specified that local and global scales can be thought of as two interrelated processes. McDonald's offers a case in point. Just as Golden Arches restaurants open their doors in country after country, no doubt a globalizing presence, these franchises alter their menus to cater to place-based diets, a localizing force.[30] Tourism packages from the Rocky Mountain Motor Company of Denver, a subsidiary of the Gray Line Company, delivers another illustration. While trip options varied by location—one choice was a bus tour through the Big Thompson Canyon—the Gray Line advertised itself as a "Great International Sight-Seeing Organization."[31] Travelers experienced their vacations locally, but the Gray Line facilitated the movement of tourists and money globally. From a vantage point of interrelated systems, smaller or larger scales are simply networks that are more or less connected.

The Anthropocene, however, muddles how we usually experience people and place on local scales. This epoch posits that the human species has become a significant geophysical force, shaping the face of the Earth as much as plate tectonics or volcanoes do. One obstacle of the Anthropocene is that most people do not relate to being cast as a collective geomorphic catalyst. In a 2009 article, postcolonial historian Dipesh Chakrabarty has pointed out this reality. "To call human beings geological agents," Chakrabarty remarked, "is to scale up our imagination of the human."[32] For example, seldom do we compare ourselves to the erosive powers of wind, water, and ice. But in regards to highway-building in the Big Thompson Canyon, construction workers became just that: a telluric force. The embrace of fossil fuel-powered technologies—earthmoving equipment in particular—allowed Coloradans to reshape the mountain canyon much like the Big Thompson River had done over millennia. By adding up the erosion rates for road construction, mineral extraction, and industrial agriculture over the Great Acceleration, geoscientists have calculated that humans and their hydrocarbon machines moved more of the Earth's crust than *all* other material processes.[33] From the 1930s onwards, Coloradans exercised Anthropocene agency in the canyon each time they reconstructed a thoroughfare. Most recently, after the 2013 deluge, road-building crews used around seventy pieces of heavy equipment to haul off 650 truckloads of debris, bring in 2,700 truckloads of concrete, dump 51,000 tons of "road base" fill, and pour 22,000 tons of asphalt to reestablish U.S. Highway 34.[34] This was geophysical agency all over again. The local actions of particular people in particular places, taken in aggregate with similar human activities, have global consequences for our collective species on our collective planet.

Recognizing humans as a force of nature also brings the humanities and sciences closer together, which, in dialogue, helps to reformulate questions of scale. Environmental historian Julia Thomas, in a 2014 essay, examined how various biological sciences have redefined what "the human" has traditionally meant for historians. At one end of the spectrum, paleo-biologists and other geochronologists have construed humans as a collective species functioning over eons of time. As Chakrabarty had previously articulated, Thomas emphasized that "one challenge for historians, perhaps *the* outstanding challenge, is to understand this new aggregate figure of the human."[35] At the other end, microbiologists and biochemists have characterized humans as amalgamations of microbes and industrial toxins as much as individual beings. With recent scientific studies, the post-Enlightenment distinction between the body and environment blurs together. “Biologists work on many scales,” Thomas concluded, “and in engaging with them, historians fruitfully learn to see the human on different scales as well.”[36] On the macro-level of species or the micro-level of bodies, discussions between history and science bring new conceptions of time and space to the table.

During the Anthropocene, one major challenge for environmental scholars is shifting between local and global levels. Chakrabarty, again, has engaged this theme by asserting that the Anthropocene necessitates the convergence of historical scales. In order to comprehend how complex interactions among the Earth system, human evolution, and industrial civilization have contributed to anthropogenic global warming, Chakrabarty maintained, “requires us to move back and forth between thinking on these different scales all at once.”[37] In a 2007 article, environmental historian Libby Robin and climate scientist Will Steffen have also called attention to the problem of scale in the Anthropocene. They asserted that historical narratives “must be written on a case-suitable scale that is amenable to international comparison and can speak to issues beyond scale. The challenge is scaling up and down.”[38] The Anthropocene, they reasoned, obliges scholars to help their audiences to comprehend the interchanges between human history and Earth history. The challenge lies in moving fluidly across analytical levels: from human beings to the human species, from place to planet, and back again.

In the Anthropocene, this human-induced era of rapid global change, more and more historians are recognizing their academic responsibility to produce stories where the individual and the collective are interacting components. In her 2014 book, *Writing History in the Global Era*, cultural historian Lynn Hunt has argued that by tracing the connections between the narrow self and wider society, scholars may push the limits of historical understanding. Hunt cautioned that a global scale tends to favor economic factors as causal explanations. Nonetheless, Hunt has proposed that the discipline as a whole may benefit from merging different globalization paradigms, commonly utilized in macro-oriented narratives, with socio-cultural theories, which are usually employed by micro-level studies.[39] "History's purposes are expanding," Hunt has observed, "as we increasingly think of ourselves as humans sharing with each other and with other species a common planetary past and future."[40] Within the field, the scale of historical imagination is adapting to the scale of global interdependence.

In a similar manner, the historians Jo Guldi and David Armitage encourage a return to historical examinations over longer time scales. In their 2014 work, *The History Manifesto*, Guldi and Armitage have argued that a resurgence of what historian Fernand Braudel called the *longue durée* may alleviate the present crisis of myopic public discourse. The Anthropocene, with its linkages to geologic time and space, supports the development towards "richly recovered moments cast within a larger framework."[41] The human impact of the Great Acceleration, for instance, assumes a deeper significance for the Big Thompson Canyon when accompanied by the human-environmental relationships over eons of time. Only with the exploration of the deep past does the utilization of fossil fuels within the canyon prove to be a decisive turning point in how Coloradans related to their material surroundings.[42] "History's power," Guldi and Armitage have asserted, "ultimately lies in…tacking between big processes and small events to see the whole picture."[43] For these two authors, micro-histories often fail when they leave readers unable to grasp both the whole and the particular.[44] The Anthropocene, at least as a conceptual tool, offers one promising avenue for helping audiences see the forest for the trees.

In reality, the writings of Chakrabarty, Thomas, and Hunt, as well as Guldi and Armitage, are part of an international dialogue about scale that extends far beyond academic circles. In his 2015 encyclical on climate change, Pope Francis sought to acknowledge the uniqueness of each individual while recognizing a moral duty to the collective whole. "Because all creatures are connected," Francis remarked, "each must be cherished with love and respect, for all of us as living creatures are dependent on one another."[45] From a perspective of what the Pontiff has called "integral ecology," personal awareness of a common home on Earth may result in an individual obligation to the common, or collective, good. "Unless they are integrated into a broader vision of reality," Francis upheld, "the fragmentation of knowledge and the isolation of bits of information can actually become a form of ignorance."[46] While, historically speaking, only a small fraction of the world's population possesses intergenerational responsibility for global changes, the Anthropocene epoch offers a sense of universal solidarity in the present.[47] Particularly, this new geologic age speaks to the fact that human actions have consequences for all human and nonhuman nature. As a theoretical framework, the Anthropocene could assist scholars in merging the local and the global, the individual and the collective, the particular and the general, for a more holistic understanding of the past.

## *Anthropocene History?*

In this way, the challenge may also provide a solution. Using the Anthropocene as a different way of doing history allows scholars to make stronger connections between micro-level systems and macro-oriented Earth processes. In the case of the Big Thompson Canyon, local and global scales were interconnected through the technologically-mediated carbon and hydrological cycles. Just as water molecules from the Pacific Ocean and Gulf of Mexico became the Big

Thompson River, carbon dioxide emitted from tailpipes within the canyon joined greenhouse gases from highways throughout the world. Through these material cycles, the interweaving of local particulars with a global generalization, local individuals with a global collective, becomes more intelligible. In this narrative, the Anthropocene allowed for linking a local disaster to the global upsurge in roads, cars, tourism, atmospheric $CO_2$, and flood severity over the Great Acceleration. All these connections are probably why Guldi and Armitage reasoned: “The seeds of a new conversation about the future of the past and the big picture are already planted, indeed they represent the reasons why Big History, Deep History, and the Anthropocene are on the rise today.”[48] The Anthropocene, like the actual geologic layers, compresses time and space.

Telling stories about the Anthropocene grounds this global abstraction into a local reality that allows readers to see the collective effects of human society. Climate change, mass species extinctions, and other Earth-systems perturbations are difficult to grasp because they all occur beyond our usual human sensibilities. This problem originates somewhat from the nature of Earth-systems research. Recognition of a new geologic epoch is partly the byproduct extensive computer modeling and mass statistical evaluations. A central irony is that the technological and industrial developments that have allowed scientists to measure the Anthropocene are the same forces that helped to produce it. Still, the analyses of large data sets nonetheless represent well-documented material changes from the lithosphere to atmosphere to hydrosphere. This disaster story traced the human modifications of land, air, and water and then moved the narrative focus from local alterations to bigger transformations. Social historians are normally cited as doing history “from the bottom up.” In contrast, scholar Ted Steinberg has argued that environmental historians practice history “from the ground up.”[49] But narrating an “Anthropocene” history is different even from Steinberg’s notion. It might be conceived as telling stories “from the earth up… to *the* Earth." By and large, Anthropocene history offers more opportunities for upscaling and downscaling in narrative accounts.

Moving past the sheer numbers that comprise the Great Acceleration, which portray the macro-level economic, social, and environmental forces, Anthropocene history still relies on micro-level analyses. With narratives written on smaller scales, cultural factors become most apparent. The idea that united Coloradans throughout these chapters, in the ways they constructed highways, traveled for vacations, and made political decisions, was the value they placed on "acceleration," or trying to increase their rate of speed. The momentum of the Great Acceleration sustained how most people thought. But these attitudes and outlooks, along with actions that undergirded the Great Acceleration itself, were imbedded within a physical context. And this material reality was an energy abundance in fossil fuels. An Anthropocene history of the Big Thompson Flood has uncovered that oil wealth, in particular, shaped Coloradans' values as a telluric force.

Canyons, and other areas of palpable geological activity, are also ideal places for thinking about Anthropocene history. If humans are geophysical agents, then it tasks historians to explore the spaces where people interact with geologic processes in geologic ways. And if eco-modernist geographer Erle Ellis and other scientists are correct in asserting that more "anthromes" exist on our planet than "biomes," an argument which their evidence supports, then the job of analyzing the historical structures behind geophysical agency becomes more important.[50] The ability of human society to shape a geologic past was no mere accident of history. Humans as earthmovers within the Big Thompson Canyon was contingent upon an unstable alliance of nonhuman forces: capital accumulation, industrial machinery, and fossil fuels. In different geomorphic contexts, say, nuclear testing grounds or open-pit copper mines or monoculture corn farms, geophysical agency in the Anthropocene has likely rested on similar coalitions and combinations.

* * *

Every now and then, I travel through the canyon on U.S. Highway 34 from my home in Fort Collins to visit Rocky Mountain National Park. Before I reach the town of Drake, my pick-up truck passes a large sign, advertising the Carmans' Big Thompson Indian Village, and a red arrow points to its upcoming location. At the bend in the road, all I see is rubble. Occasionally, I stop my vehicle amidst the canyon walls of the Big Thompson River to fly-fish. With rod and reel in tow, the pursuit of stocked rainbow and brown trout occupies most of my attention, reminiscent of past anglers who have visited this vacationers' paradise. Between every cast laid down—while wading up and down the river—I have the opportunity to observe the surrounding landscape. My eyes oscillate from the fly pattern on a riffle of the stream to the geologic presence that looms over me. I sometimes gaze at entire portions of mountainside, some of which eroded away during the most recent flood. My thoughts quickly turn to the tremendous power of the Big Thompson River in which I stand. A shiver shoots up my spine as the water accelerates past my feet.

NOTES

[1] Alex Burness, "'No Solution' for Indian Village flood damage," *Loveland Reporter-Herald*, 11 December 2013, http://www.reporterherald.com/news/colorado-flood/ci_24697956/no-solution-indian-village-flood-damage (accessed on 15 December 2015).

[2] Kevin Duggan, "Recovering after rivers rage," *Fort Collins Coloradoan*, 5 September 2014, http://www.coloradoan.com/story/news/local/2014/09/05/september-flood-anniversary-colorado/15151647/ (accessed on 1 January 2016).

[3] James Garcia, "Indian Village: Loss of an iconic Big Thompson Canyon outpost," *Boulder Daily Camera*, 28 August 2014, http://www.dailycamera.com/colorado-flood-2013-one-year-later/ci_26388327/indian-village-loss-an-iconic-big-thompson-canyon (accessed on 15 December 2015).

[4] "Howard and Lena Carman – Owners of the Big Thompson Indian Village – Loveland, Colorado," Howard and Lena Carman owners of the Big Thompson Indian Village, http://bigthompsonindianvillage.webs.com/ (accessed on 15 December 2015); Burness, "'No Solution' for Indian Village flood damage"; Garcia, "Indian Village: Loss of an iconic Big Thompson Canyon outpost."

[5] John Lewis Gaddis, *The Landscape of History: How Historians Map the Past* (New York: Oxford University Press, 2002), 17-34; Lucy R. Lippard, *The Lure of the Local: Senses of Place in a Multicentered Society* (New York: The New Press, 1997), 4-20.

[6] Jared Orsi, *Hazardous Metropolis: Flooding and Urban Ecology in Los* Angeles (Los Angeles: University of California Press, 2004), 36-54.

[7] Orsi, *Hazardous Metropolis*, 52.

[8] C.S. Holling and Gary K. Meffe, "Command and Control and the Pathology of Natural Resource Management," *Conservation Biology* 10 (April 1996): 328-37.

[9] Ted Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America* (New York: Oxford University Press, 2000), xvii-xxv, 139-45, 149-58.

[10] Mike Davis, *Ecology of Fear: Los Angeles and the Imagination of Disaster* (New York: Henry Holt and Company, 1998), 107-09, 140-46.

[11] When all prices were adjusted to 2013 dollars, the 1930s highway would cost roughly $21.2 million, the 1970s highway would cost about $46.7 million, and the 2010s highway was some $80 million.

[12] Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999), 3-41, 203-09.

[13] Fiege, *Irrigated Eden*, 9.

[14] Mark Carey, *In the Shadow of Melting Glaciers: Climate Change and Andean Society* (New York: Oxford University Press, 2010), 4-18, 27-38, 54, 172, 189-97.

[15] For examples, see Eric Schlosser, *Command and Control: Nuclear Weapons, The Damascus Accident, and the Illusion of Safety* (New York: Penguin Books, 2013), 460-85; Paul R. Josephson, *Industrialized Nature: Brute Force Technology and the Transformation of the Natural World* (Washington, D.C.: Island Press, 2002), 1-14, 253-63. For the classic interpretative framework that informs these books, see Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (New York: Basic Books, 1984), 3-14, 62-100, 232-55.

[16] Alexander Hall, "The North Sea Flood of 1953," *Arcadia: Environment & Society Portal* 5 (2013), http://www.environmentandsociety.org/node/5181 (Accessed on 19 March 2016).

[17] Yi Si, "The World's Most Catastrophic Dam Failures: The August 1975 Collapse of Banqiao and Shimantan Dams," in *The River Dragon Has Come!: The Three Gorges Dam and the Fate of China's Yangtze River and Its People*, comp. Dai Qing, eds. John G. Thibodeau and Philip B. Williams, trans. Yi Ming (Armonk, NY: M.E. Sharpe, 1998), 25-38; EFO Staff, "The Banqiao Reservoir Dam Failure," *Engineering Failures*, http://engineeringfailures.org/?p=723 (accessed 22 January 2016).

[18] For the eco-modernist ideology, see John Asafu-Adjaye et al., "An Ecomodernist Manifesto," Eco-Modernism, http://www.ecomodernism.org/manifesto-english/ (accessed on 5 January 2016); Michael Shellenberger and Ted Nordhaus, "The Death of Environmentalism: Global Warming Politics in a Post-Environmental World," The Breakthrough Institute, 2004, http://www.thebreakthrough.org/images/Death_of_Environmentalism.pdf (accessed 5 January 2016).

[19] For the full span of geo-engineering ideas, organized under two general themes of carbon sequestration and solar-radiation management, see Clive Hamilton, *Earthmasters: The Dawn of the Age of Climate Engineering* (New Haven, CT: Yale University Press, 2013), 20-71.

[20] Erle Ellis, "Planet of No Return: Human Resilience on an Artificial Earth," *The Breakthrough Journal* (Winter 2012) http://thebreakthrough.org/index.php/journal/past-issues/issue-2/the-planet-of-no-return.

[21] John Asafu-Adjaye et al., "An Ecomodernist Manifesto," Eco-Modernism, http://www.ecomodernism.org/manifesto-english/ (accessed on 5 January 2016).

[22] Hamilton, *Earthmasters*, 158-83

[23] Naomi Oreskes and Erik M. Conway, *The Collapse of Western Civilization: A View from the Future* (New York: Columbia University Press, 2014).

[24] Naomi Oreskes and Erik M. Conway, "The Collapse of Western Civilization: A View from the Future" *Dædalus* 142 (Winter 2013): 47-48.

[25] Robert D. Jarrett and John E. Costa, *Evaluation of the Flood Hydrology in the Colorado Front Range Using Precipitation, Streamflow, and Paleoflood Data for the Big Thompson River Basin* (Denver, CO: U.S. Geological Survey, 1988), 28-30.

[26] See, for example, Thomas R. Karl and Richard W. Knight, "Secular Trends of Precipitation Amount, Frequency, and Intensity in the United States," *Bulletin of the American Meteorological Society* 79 (February 1998): 231-41.

[27] William Cronon, "Modes of Prophecy and Production: Placing Nature in History," *Journal of American History* 76 (March 1990), 1122-31; Donald Worster, "World With Borders: The Internationalizing of Environmental History," *Environmental Review* 6 (Autumn 1982): 8-13; Richard White, "The Nationalization of Nature," *Journal of American History* 86 (December 1999): 976-86.

[28] Bruno Latour, *We Have Never Been Modern*, trans. Catherine Porter (Cambridge, MA: Harvard University Press, 1993), 122.

[29] Latour, *We Have Never Been Modern*, 117.

[30] Andrew Herod, *Scale* (New York: Routledge, 2011), 227-35.

[31] Rocky Mountain Motor Company, *The Gray Line: Denver and Rocky Mountain National Park* (1967), Clippings Files: Subject- Colorado. Tourism, 1960-1969, Denver Public Library, Denver, CO.

[32] Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry* 35 (Winter 2009): 206.

[33] Bruce H. Wilkinson, "Humans as geological agents: A deep time perspective," *Geology* 33 (March 2005): 161-64; Roger LeB. Hooke, "On the history of humans as geomorphic agents," *Geology* 28 (September 2000): 843-46; P.K. Haff, "Hillslopes, rivers, plows, and trucks: mass transport of the Earth's surface by natural and technological processes," *Earth Surface Processes and Landforms* 35 (August 2010): 1157-66; Ellen Wohl, "Human impacts to mountain streams," *Geomorphology* 79 (2006): 217-48.

[34] For earthmoving figures on rebuilding U.S. 34, see Craig Young, "U.S. 34 lifeline opens, Loveland and Estes Park embrace," Loveland Reporter-Herald, 21 November 2013, http://www.reporterherald.com/news/colorado-flood/ci_24571886/public-gets-first-view-big-thompson-damage (accessed on 20 March 2016).

[35] Julia Adeney Thomas, "History and Biology in the Anthropocene: Problems of Scale, Problems of Value," *American Historical Review* 119 (December 2014): 1590.

[36] Thomas, "History and Biology in the Anthropocene," 1604.

[37] Dipesh Chakrabarty, "The Anthropocene and the Convergence of Histories," in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton, Christophe Bonneuil, and François Gemenne (New York: Routledge, 2015), 49.

[38] Libby Robin and Will Steffen, "History of the Anthropocene," *History Compass* 5 (2007): 1711.

[39] Lynn Hunt, *Writing History in the Global Era* (New York: W.W. Norton & Company, 2014), 40, 55-65, 115.

[40] Hunt, *Writing History in the Global Era*, 119.

[41] Jo Guldi and David Armitage, *The History Manifesto* (Cambridge, UK: Cambridge University Press, 2014), 121.

[42] Edmund Burke III, "The Big Story: Human History, Energy Regimes, and the Environment," in Edmund Burke III and Kenneth Pomeranz, eds., *The Environment and World History* (Berkeley: University of California Press, 2009), 33-53.

[43] Guldi and Armitage, *The History Manifesto*, 13.

[44] Ibid., 1-12, 121.

[45] Pope Francis, *Laudato Si': On Care for Our Common Home* (Vatican City: Vatican Press, 2015), 30, http://w2.vatican.va/content/dam/francesco/pdf/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si_en.pdf (accessed on 1 January 2015).

[46] Francis, *Laudato Si'*, 82

[47] For example, scholar Jean-Baptise Fressoz posits that the new geological epoch should be called the "Anglocene" as 65% all carbon emissions from 1850 to 1950 came from two countries alone: Great Britain and the United States. For his argument, see Jean-Baptiste Fressoz, "Losing the Earth Knowingly: Six Environmental Grammars around 1800," in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton, Christophe Bonneuil, and François Gemenne (New York: Routledge, 2015), 71.

[48] Guldi and Armitage, *The History Manifesto*, 118.

[49] Ted Steinberg, *Down to Earth: Nature's Role in American History*, Third Edition (New York: Oxford University Press, 2013), vi.

[50] Erle C. Ellis et al., "Anthropogenic transformation of the biomes, 1700 to 2000," *Global Ecology and Biogeography* 19 (May 2010): 589-606.

BIBLIOGRAPHY

*Primary Sources*

American Society of Civil Engineers. *Constitution and List of Members*. New York: American Society of Civil Engineers, 1910.

"Annual Park Visitation (1904 – last calendar year)." Rocky Mountain National Park Reports, https://irma.nps.gov/ Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20%281904%20-%20Last%20Calendar%20Year%29?Park=ROMO (accessed 8 April 2015).

Asafu-Adjaye, John, Linus Blomqvist, Stewart Brand, Barry Brook, Ruth Defries, Erle Ellis, Christopher Foreman, David Keith, Martin Lewis, Mark Lynas, Ted Norhaus, Roger Pielke, Jr., Rachel Pritzker, Joyashree Roy, Mark Sagoff, Michael Schellenberger, Robert Stone, and Peter Teague. "An Ecomodernist Manifesto." Eco-Modernism, http://www.ecomodernism.org/manifesto-english/ (accessed on 5 January 2016).

Association for Environmental Studies and Sciences (AESS) 2014 Conference. "Welcome to the Anthropocene: From Global Challenge to Planetary Stewardship." Association for Environmental Studies and Sciences, http://www.aess.info/content.aspx?page_id=22&club_id=939971&module_id=154815 (accessed on 30 May 2015).

Baker, Ira O. "Engineering Education in the United States at the End of the Century," *Science* 12 (November 1900): 668.

Beals, Ralph L. *Ethnology of Rocky Mountain National Park: The Ute and Arapaho*. Berkeley, CA: U.S. Department of Interior, 1935. Native American Interpretative Files, Rocky Mountain National Park Archives, Estes Park, Colorado.

Binder: BTCA History. Big Thompson Canyon Association, Drake, Colorado.

Binder: BTCA Minutes 1949-57. Big Thompson Canyon Association, Drake, Colorado.

Binder: BTCA Minutes 1958-63. Big Thompson Canyon Association, Drake, Colorado.

Binder: Fish / Sanitation Committee. Big Thompson Canyon Association, Drake, Colorado.

Blanchard, Arthur H., and Henry D. Drowne. *Text-Book on Highway Engineering*. New York: John Wiley & Sons, 1914.

*Boulder Daily Camera*, 1976, 2014.

Box 1: Colorado Paper Souvenirs. Estes Park Museum, Colorado.

Box 14: Geographic Files, 978.8 Colorado, 1930-1940-1951-1956. Stephen H. Hart Research Library, Colorado Historical Society, Denver.

Box 23: 079-71-A0111. Record Group 79: National Park Service. National Archives and Records Administration, Broomfield, Colorado.

Box 6: Vacationland 1951-1966. Estes Park Museum, Colorado.

Boxes 1-2: Estes Park (EP) Vacation Guides and Brochures. Estes Park Museum, Colorado.

Brown, Lester R., Michael Renner, and Brian Halweil. *Vital Signs, 1999: The Environmental Trends that Are Shaping Our Future*. New York: W.W. Norton & Company, 1999.

Bruce, Arthur G. *Highway Design and Construction*. Scranton, PA: International Textbook Company, 1934.

"Climate at a Glance—Global Time Series." National Oceanic & Atmospheric Association. National Center for Environmental Information. https://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/ytd/7/1880-2015 (accessed on 26 August 2015).

*Colorado Highways*, 1930-1932. Shumate Building Library, Colorado Department of Transportation, Denver.

Crutzen, Paul, and Eugene Stoermer. "The Anthropocene." *International Geosphere-Biosphere Programme's Global Change Newsletter* 41 (May 2000): 17-18.

Crutzen, Paul. Interview by Christian Schwägerl, 2013. Deutsches Museum, Environment and Society Portal, http://www.environmentandsociety.org/exhibitions/anthropocene/huge-variety-possibilities-interview-nobel-laureate-paul-crutzen-his-life (accessed on 5 January 2016).

David McComb Big Thompson Flood Collection. Water Resources Archive, Colorado State University Libraries, Fort Collins.

*Denver Democrat*, 1945.

*Denver Post*, 1937-1939, 1945, 1976-1977, 2013.

Drake Home Demonstration Club. *History of the Big Thompson Canyon*. Larimer County, CO: Works Progress Administration, 1939. Western History Collection, Denver Public Library, Colorado.

Earth Policy Institute Data Center. “Miles Traveled by Cars, Trucks, and Motorcycles in the United States, 1960-2012.” Earth Policy Institute, http://www.earth-policy.org/data_center/C23 (accessed on 24 August 2015).

Ellis, Erle. “Planet of No Return: Human Resilience on an Artificial Earth.” *The Breakthrough Journal* (Winter 2012) http://thebreakthrough.org/index.php/journal/past-issues/issue-2/the-planet-of-no-return (accessed on 16 February 2016).

Environmental Protection Agency. Office of Mobile Sources. “Automobile Emissions: An Overview.” 1992.

Environmental Protection Agency. Office of Transportation and Air Quality. “Questions and Answers: Greenhouse Gas Emissions from a Typical Passenger Vehicle.” May 2014.

Ephemera Box 1: Recreation Development. Rocky Mountain National Park Archives, Estes Park, Colorado.

*Estes Park Trail*, 1937-1938.

*Estes Park Trail-Gazette*, 1976-1977.

*Fort Collins Coloradoan*, 1976-1977, 2013-2014.

*Fort Collins Express-Courier*, 1938.

*Fort Collins Leader*, 1938.

*Fort Collins Triangle Review*, 1976-1977.

Governor Richard D. Lamm Collection. Colorado State Archives, Denver.

*Greeley Daily Tribune*, 1955, 1960.

*Greeley Tribune*, 1976.

Greensfelder, Nelson Sutro, and Harry Roberts, Jr., editors. “Charles Davis Vail – a Biography.” *Explosives Engineer* 13 (November 1935): 321-25, University of Michigan Libraries.

Gruntfest, Eve C. “What People Did During the Big Thompson Flood.” Natural Hazard Research, Institute of Behavior Science, University of Colorado-Boulder, August 1977.

Guha-Sapir, D., R. Below, and Ph. Hoyois. “EM-DAT: International Disaster Database.” Université Catholique de Louvain, Brussels, Belgium, http://www.emdat.be/disaster_trends/index.html (accessed on 12 April 2015).

Hamilton, Clive. “The Delusion of the ‘Good Anthropocene’: Reply to Andrew Revkin.” www.clivehamilton.com, 17 June 2014, http://clivehamilton.com/the-delusion-of-the-good-anthropocene-reply-to-andrew-revkin/ (accessed on 30 May 2015).

“Historical Census Population.” Department of Local Affairs, State of Colorado, https://dola.colorado.gov/demog_webapps/hcpParameters.jsf (accessed on 13 September 2015).

Kelchner, Warren. “The Pan American Highway.” *Foreign Affairs,* 1 July 1938, https://www.foreignaffairs.com/articles/united-states/1938-07-01/pan-american-highway (accessed on 26 June 2015).

Larimer County Clerk and Recorder. “Property Information,” Public Records Databases, http://maps.larimer.org/lil/?xCenter=2999439&yCenter=1483559&Scale=640000 (accessed on 9 September 2015).

League of Nations. “No. 4354- UNITED STATES OF AMERICA, ARGENTINE REPUBLIC, BOLIVIA, BRAZIL, CHILE, etc. Convention on the Pan-American Highway, adopted by the Inter-American Conference for the Maintenance of Peace. Signed at Buenos Aires, December 23rd, 1936.” *Treaties and International Engagements registered with the Secretariat of the League of Nations* 188 (1938): 99-106.

*Loveland Daily Reporter-Herald*, 1976-1977.

*Loveland Reporter-Herald*, 2013.

Maddox, Robert A., Fernando Caracena, Lee R. Hoxit, and Charles F. Chappell. “Meteorological Aspects of the Big Thompson Flash Flood of 31 July 1976.” *NOAA Technical Report ERL 388-APCL 41* (July 1977): 1-83.

McCain, Jerald F., and Robert D. Jarrett. *Manual for Estimating Flood Characteristics of Natural-Flow Streams in Colorado*. Denver: Colorado Water Conservation Board, 1976.

Microfilm Roll C-31. Central Files. Headquarters Building, Colorado Department of Transportation, Denver.

Microfilm Roll C-32. Central Files. Headquarters Building, Colorado Department of Transportation, Denver.

Miscellaneous Highway Collection. Shumate Building Library, Colorado Department of Transportation, Denver.

Newspaper Clippings: Biography- Vail, Charles D. Denver Public Library, Denver, Colorado.

Newspaper Clippings: Subject- Colorado, Tourism, 1960-1969. Denver Public Library, Denver, Colorado.

Newspaper Clippings: Subject- Roads. Colorado, State Highway #16. Big Thompson. Denver Public Library, Denver, Colorado.

Northern Colorado Flood Oral History Collection. Water Resources Archive, Colorado State University Libraries, Fort Collins.

Organizations- Estes Park Chamber of Commerce, MSP 1987:00.005. Estes Park Museum, Colorado.

Organizations- Estes Park Chamber of Commerce, MSP 2005:023.039-.044. Estes Park Museum, Colorado.

Papers of Daryl B. Simons. Water Resources Archive, Colorado State University Libraries, Fort Collins.

Papers of Maurice L. Albertson. Water Resources Archive, Colorado State University Libraries, Fort Collins.

Papers of William P. Stanton. Water Resources Archive, Colorado State University Libraries, Fort Collins.

Records of Wright Water Engineers, Inc. Water Resources Archive, Colorado State University Libraries, Fort Collins.

Revkin, Andrew C. "A Darker View of the Age of Us – the Anthropocene." *New York Times*, Dot Earth Opinion, 18 June 2014, http://dotearth.blogs.nytimes.com/2014/06/18/a-darker-view-of-the-age-of-us-the-anthropocene/?_r=0 (accessed on 30 May 2015).

Revkin, Andrew. "Paths to the 'Good' Anthropocene." YouTube, 20 June 2014, https://www.youtube.com/watch?v=VOtj3mskx5k (accessed on 30 May 2015).

Right-of-Way Maps. Online Transportation Information System, Colorado Department of Transportation, http://dtdapps.coloradodot.info/otis (accessed on 16 February 2016).

*Rocky Mountain Contractor*, 1937-1945. Gemmill Library, University of Colorado, Boulder.

*Rocky Mountain News*, 1943, 1945, 1976.

Scripps Institution of Oceanography. "The Keeling Curve: A Daily Record of Atmospheric Carbon Dioxide." https://scripps.ucsd.edu/programs/keelingcurve/ (accessed on 24 August 2015).

Shellenberger, Michael, and Ted Nordhaus. "The Death of Environmentalism: Global Warming Politics in a Post-Environmental World." The Breakthrough Institute, 2004, http://www.thebreakthrough.org/images/Death_of_Environmentalism.pdf (accessed 5 January 2016).

Soule, James, William P. Rogers, and David C. Shelton. "Geological Hazards, Geomorphic Features, and Land-Use Implications in the Area of the 1976 Big Thompson Flood, Larimer County, Colorado." *Environmental Geology* 10. Denver: Colorado Geological Survey, 1976. Morgan Library, Colorado State University, Fort Collins.

Sprague, A. E. "Pioneering on the Big Thompson and in Estes Park." *Colorado Magazine* 12 (May 1935): 92-97. Stephen H. Hart Research Library, Colorado Historical Society, Denver.

Sprague, A.E. Manuscript Collection #597. Stephen H. Hart Research Library, Colorado Historical Society, Denver.

Sprague, Abner E. *My Pioneer Life: The Memoirs of Abner E. Sprague*. Estes Park, CO: Rocky Mountain Nature Association, 1999.

Toll, Oliver W. *Arapaho Names and Trails: A Report of a 1914 Pack Trip*. Denver, CO: privately printed, 1962. Native American Interpretative Files, Rocky Mountain National Park Archives, Estes Park, Colorado.

Transportation- Colorado Department of Highways. Colorado State Archives, Denver.

Tretyakova, Albina, and Barry L. Kostinsky. *USSR: Motor Fuel Use and Conservation in Transportation and Agriculture, 1970 to 1984*. Washington, D.C.: Center for International Research, 1987.

U.S. Congress. Transcript of the National Industrial Recovery Act (1933). Ourdocuments.gov, http://www.ourdocuments.gov/doc.php?flash=true&doc=66&page =transcript (accessed on 16 February 2016).

U.S. Department of Commerce. Bureau of Domestic and Foreign Commerce. *Statistical Abstract of the United States, 1930*. Washington, D.C.: Government Printing Office, 1930.

U.S. Department of Commerce. Bureau of Public Roads. *Highway Statistics, 1950*. Washington, D.C.: Government Printing Office, 1952.

U.S. Department of Commerce. Bureau of the Census. *Statistical Abstract of the United States, 1984*. Washington, D.C.: Government Printing Office, 1983.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. *Big Thompson Flash Flood of July 31 – August 1, 1976.* Rockville, Maryland: Government Printing Office, 1976.

U.S. Department of Transportation. Federal Highway Administration. *Highway Statistics, 1970*. Washington, D.C.: Government Printing Office, 1970.

U.S. Department of Transportation. Federal Highway Administration. *Highway Statistics, 1965*. Washington, D.C.: Government Printing Office, 1965.

U.S. Department of Transportation. Federal Highway Administration. *Highway Statistics, 1975*. Washington, D.C.: Government Printing Office, 1975.

U.S. Energy Information Administration. "U.S. Field Production of Crude Oil," U.S. Department of Energy, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=A (accessed on 11 July 2015).

U.S. Water Resources Council. *Guidelines for Determining Flood Flow Frequency*, Bulletin #17A of the Hydrology Subcommittee. 1976; Washington, D.C.: Government Printing Office, 1977.

United Nations. "Roads, paved (% of total roads)." UN data http://data.un.org/Data.aspx?d=WDI&f=Indicator_Code%3AIS.ROD.PAVE.ZS#WDI (accessed on 16 February 2016).

United Nations. Department of Economic and Social Affairs. *Growth of the World's Urban and Rural Population, 1920-2000.* New York: United Nations, 1969.

United Nations. *The World's Women 2000: Trends and Statistics*. New York: United Nations, 2000.

"Urban Population (% of Total)." World Bank, http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries?display=graph (accessed on 13 September 2015).

Vail, Charles Davis. "Highway Location in the Foothills of the Rocky Mountains in a Cloudburst Area." Master's Thesis, University of Illinois, 1936. Oak Street Archives, University of Illinois, Urbana-Champaign.

Vail, Charles Davis. "Thesis on Tensile Strength of Portland Cement & Lime in Mortar." Bachelor's thesis, University of Illinois, 1891. Oak Street Archives, University of Illinois, Urbana-Champaign.

Wamsley, Sharlynn, editor. *Reflections on the River: The Big Thompson Canyon Flood*. Denver: Drake Club Press, 2001.

Waterdale Station, CO, US, COOP: 058839. “Annual Climatological Summary (1931).” National Oceanic & Atmospheric Association. National Center for Environmental Information. http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:058839/detail (accessed on 26 August 2015).

Waterdale Station, CO, US, COOP: 058839. “Annual Climatological Summary (1950).” National Oceanic & Atmospheric Association. National Center for Environmental Information. http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:058839/detail (accessed on 26 August 2015).

Waterdale Station, CO, US, COOP: 058839. “Annual Climatological Summary (1976).” National Oceanic & Atmospheric Association. National Center for Environmental Information. http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:058839/detail (accessed on 26 August 2015).

Waterdale Station, CO, US, COOP: 058839. “Annual Climatological Summary (2010).” National Oceanic & Atmospheric Association. National Center for Environmental Information. http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:058839/detail (accessed on 26 August 2015).

Wellington, Arthur Mellon. *The Economic Theory of the Location of Railways.* New York: John Wiley & Sons, 1887.

Working Group on the ‘Anthropocene.’” Subcommission on Quaternary Statigraphy, http://quaternary.stratigraphy.org/workinggroups/anthropocene/ (accessed 26 January 2016).

World Bank, “International tourism, receipts (current US$).” http://data.worldbank.org/indicator/ST.INT.RCPT.CD (accessed 9 April 2015).

World Tourism Organization. *UNWTO Tourism Highlights*, 2011 Edition, http://mkt.unwto.org/sites/all/files/docpdf/unwtohighlights11enhr.pdf (accessed 9 April 2015.

*Secondary Sources*

“A Planet of Suburbs.” *The Economist*, 1 March 2014, http://www.economist.com/suburbs (accessed on 13 September 2015).

Andrews, Thomas G. “‘Made by Toile’?: Tourism, Labor, and the Construction of the Colorado Landscape, 1858-1917.” *Journal of American History* 92 (December 2005): 837-63.

————. *Coyote Valley: Deep History in the High Rockies.* Cambridge, MA: Harvard University Press, 2015.

———. *Killing for Coal: America's Deadliest Labor War*. Cambridge, MA: Harvard University Press, 2008.

Aron, Cindy S. *Working at Play: A History of Vacations in the United States*. New York: Oxford University Press, 1999.

"Arapaho." In *Encyclopedia of American Indian History,* Vol. 4, edited by Bruce E. Johansen and Barry M. Pritzker. Santa Barbara, CA: ABC-Clio, 2008.

Barnett, Tim P., David W. Pierce, Hugo G. Hidalgo, Celine Bonfils, Benjamin D. Santer, Tapash Das, Govindasamy Bala, Andrew W. Wood, Toru Nozawa, Arthur A. Mirin, Daniel R. Cayan, and Michael D. Dettinger. "Human-Induced Changes in the Hydrology of the Western United States." *Science* 319 (February 2008): 1080-83.

Baron, Jill S., editor. *Rocky Mountain Futures: An Ecological Perspective*. Washington, D.C.: Island Press, 2002.

Bashford, Alison. "The Anthropocene is Modern History: Reflections on Climate and Australian Deep Time." *Australian Historical Studies* 44 (2013): 341-49.

Beauregard, Robert A. *When America Became Suburban.* Minneapolis: University of Minnesota Press, 2006.

Benedict, James B. "Footprints in the Snow: High-Altitude Cultural Ecology of Colorado Front Range, U.S.A." *Arctic and Alpine Research* 24 (1992): 11-14. Archeological Files, Rocky Mountain National Park Archives, Estes Park, Colorado.

———. *Old Man Mountain: A Vision Quest Site in the Colorado High Country*, Research Report No. 4. Ward, CO: Center for Mountain Archeology, 1985.

———. *The Game Drives of Rocky Mountain National Park*, Research Report No. 7. Ward, CO: Center for Mountain Archeology, 1996. Archeological Files, Rocky Mountain National Park Archives, Estes Park, Colorado.

Berger, Arthur Asa. *Ads, Fads, and Consumer Culture: Advertising's Impact on American Character and Society*, Third Edition. New York: Rowman & Littlefield Publishers, 2007.

"Big Thompson Canyon, July 31 – Aug. 1, 1976." National Center for Atmospheric Research, http://www.assessment.ucar.edu/flood/flood_summaries/07_31_1976.html (accessed on 24 September 2015).

Biggs, David A. *Quagmire: Nation-building and Nature in the Mekong Delta*. Seattle: University of Washington Press, 2010.

Billington, David P. *The Innovators: The Engineering Pioneers Who Made America Modern*. New York: John Wiley & Sons, 1996.

Billington, David P., and Donald C. Jackson. *Big Dams of the New Deal Era: A Confluence of Engineering and Politics*. Norman: University of Oklahoma Press, 2006.

Blackbourn, David. *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany*. New York: W.W. Norton & Company, 2006.

Boxell, Mark. "Rapid Ascent: Rocky Mountain National Park in the Great Acceleration, 1945-present." Master's thesis, Colorado State University, 2016.

Bramwell, Lincoln. *Wilderburbs: Communities on Nature's Edge*. Seattle: University of Washington Press, 2014.

Brands, H.W. *American Colossus: The Triumph of Capitalism, 1865-1900*. New York: Doubleday, 2010.

Braudel, Fernand. *On History*, translated by Sarah Matthews. Chicago: University of Chicago Press, 1980.

Brooks, Karl. *Public Power, Private Dams: The Hells Canyon High Dam Controversy*. Seattle: University of Washington Press, 2006.

Brown, Jen Corrinne. *Trout Culture: How Fly Fishing Forever Changed the Rocky Mountain West*. Seattle: University of Washington Press, 2015.

Burke III, Edmund. "The Big Story: Human History, Energy Regimes, and the Environment." In *The Environment and World History*, edited by Edmund Burke III and Kenneth Pomeranz. Berkeley: University of California Press, 2009.

Cannings, Richard. *The Rockies: A Natural History*. Vancouver, BC: Greystone Books, 2005.

Carey, Mark. "Science, Models, and Historians: Toward a Critical Climate History." *Environmental History* 19 (April 2014): 354-64.

————. *In the Shadow of Melting Glaciers: Climate Change and Andean Society*. New York: Oxford University Press, 2010.

Caro, Robert A. *The Power Broker: Robert Moses and the Fall of New York*. New York: Alfred A. Knopf, 1974.

Castonguay, Stéphane. "The Production of Flood as Natural Catastrophe: Extreme Events and the Construction of Vulnerability in the Drainage Basin of the St. Francis River (Quebec), Mid-nineteenth to Mid-twentieth Century." *Environmental History 12* (October 2007): 820-44.

Chakrabarty, Dipesh. "The Climate of History: Four Theses." *Critical Inquiry* 35 (Winter 2009): 197-222.

Cioc, Mark. *The Rhine: An Eco-biography, 1815-2000*. Seattle: University of Washington Press, 2002.

Claudia Tebaldi, Katharinec Hayhoe, Julie M. Arblaster, and Gerald A. Meehl. "Going to the Extremes: An Intercomparison of Model-Simulated Historical and Future Change in Extreme Events." *Climatic Change* 79 (October 2006): 185-211.

Cohen, Lizabeth. *A Consumer's Republic: The Politics of Mass Consumption in Postwar America.* New York: Alfred A. Knopf, 2003.

Cook, Terri. "Disaster strikes along Colorado's Front Range." *EARTH Magazine*, January 2014, http://www.earthmagazine.org/article/disaster-strikes-along-colorados-front-range (accessed on 26 March 2015).

Cronon, William, editor. *Uncommon Ground: Toward Reinventing Nature*. New York: W.W. Norton & Company, 1995.

————. "Modes of Prophecy and Production: Placing Nature in History." *Journal of American History* 76 (March 1990): 1122-31.

————. "The Uses of Environmental History." *Environmental History Review* 17 (Autumn 1993): 1-22.

————. *Changes in the Land: Indians, Colonists, and the Ecology of New England*. New York: Hill and Wang, 1983.

————. *Nature's Metropolis: Chicago and the Great West*. New York: W.W. Norton & Company, 1991.

Crosby, Alfred W. *Children of the Sun: A History of Humanity's Unappeasable Appetite for Energy*. New York: W.W. Norton & Company, 2006.

————. *Ecological Imperialism: The Biological Expansion of Europe, 900-1900,* Second Edition. 1986; New York: Cambridge University Press, 2004.

Crutzen, Paul. "Geology of Mankind." *Nature* 415 (January 2002): 23.

Cuny, Frederick C. *Disasters and Development*. New York: Oxford University Press, 1983.

Cushman, Gregory T. *Guano and the Opening of the Pacific World: A Global Ecological History*. New York: Cambridge University Press, 2013.

Dai, Aiguo. “Recent Climatology, Variability, and Trends in Global Surface Humidity.” *Journal of Climate* 19 (August 2006): 3589-606, http://journals.ametsoc.org/doi/pdf/10.1175/JCLI3816.1 (accessed on 17 March 2016).

Davis, Mike. *Ecology of Fear: Los Angeles and the Imagination of Disaster*. New York: Henry Holt and Company, 1998.

De Castro, Fabio. “From Myths to Rules: The Evolution of Local Management in the Amazonian Floodplain.” *Environment and History* 8 (2002): 197-216.

Easterling David R., Gerald A. Meehl, Camille Parmesan, Stanley A. Changnon, Thomas R. Karl, and Linda O. Mearns. “Climate Extremes: Observations, Modeling, and Impacts.” *Science* 22 (September 2000): 2068-74.

Elias, Scott A. *Rocky Mountains*. Washington, D.C.: Smithsonian Institution Press, 2002.

Ellis, Erle C., Kees Klein Goldewijk, Stefan Siebert, Deborah Lightman, and Navin Ramankutty. “Anthropogenic transformation of the biomes, 1700 to 2000.” *Global Ecology and Biogeography* 19 (May 2010): 589-606.

Elmore, Bartow J. *Citizen Coke: The Making of Coca-Cola Capitalism*. New York: W. W. Norton & Company, 2015.

Endfield, Georgina H. “Exploring Particularity: Vulnerability, Resilience, and Memory in Climate Change Discourse.” *Environmental History* 19 (April 2014): 303-10.

Endfield, Georgina H., Isabel Fernández Tejedo, Sarah L. O’Hara. “Conflict and Cooperation: Water, Floods, and Social Response in Colonial Guanajuato Mexico.” *Environmental History* 9 (April 2004): 221-47.

English, Joseph M., and Stephen T. Johnston. “The Laramide Orogeny: What Were the Driving Forces?” *International Geology Review* 46 (2004): 833-37.

Evans, Howard Ensign, and Mary Alice Evans. *Cache la Poudre: The Natural History of a Rocky Mountain River*. Niwot: University Press of Colorado, 1990.

Environmental Protection Agency. *Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation, and Environmental Quality*. Washington, D.C.: Government Printing Office, 2000.

Feldman, James W. "The Need for Legible Landscapes: Environmental History and NPS Management at Apostle Islands National Lakeshore." *George Wright Forum* 28 (2011): 148-60.

Fenn, Elizabeth A. *Pox Americana: The Great Smallpox Epidemic of 1775-82*. New York: Hill & Wang, 2001.

Fiege, Mark. "The Nature of the West and the World." *Western Historical Quarterly* 42 (Autumn 2011): 305-12.

————. "The Weedy West: Mobile Nature, Boundaries, and Common Space in the Montana Landscape." *Western Historical Quarterly* 36 (Spring 2005): 22-47.

————. *Irrigated Eden: The Making of an Agricultural Landscape in the American West*. Seattle: University of Washington Press, 1999.

————. *The Republic of Nature: An Environmental History of the United States*. Seattle: University of Washington Press, 2012.

Finch, James Kip. *Engineering and Western Civilization.* New York: McGraw-Hill, 1951.

Follansbee, Robert, and Leon R. Sawyer. *Floods in Colorado*, Water-Supply Paper 997. Washington, D.C.: Government Printing Office, 1948.

Folz, Richard C. "Does Nature Have Historical Agency? World History, Environmental History, and How Historians Can Help Save the Planet." *The History Teacher* 37 (November 2003): 9-28.

Francis, Pope. *Laudato Si': On Care for Our Common Home*. Vatican City: Vatican Press, 2015.

Frank, Alison Fleig. *Oil Empire: Visions of Prosperity in Austrian Galicia*. Cambridge, MA: Harvard University Press, 2005.

Frank, Jerry J. *Making Rocky Mountain National Park: The Environmental History of an American Treasure*. Lawrence: University Press of Kansas, 2013.

Freeman, Joshua B. *American Empire: The Rise of Global Power, the Democratic Revolution at Home, 1945-2000*. New York: Penguin Books, 2012.

Frich, P., L. V. Alexander, P. Della-Marta, B. Gleason, M. Haylock, A. M. G. Klein Tank, T. Peterson. “Observed coherent changes in climatic extremes during the second half of the twentieth century.” *Climate Research* 19 (January 2002): 193-212.

Furlough, Ellen. “Making Mass Vacations: Tourism and Consumer Culture in France, 1930s to 1970s.” *Comparative Studies in Society and History* 40 (April 1998): 247-86.

Gaddis, John Lewis. *The Landscape of History: How Historians Map the Past*. New York: Oxford University Press, 2002.

Gerald A. Meehl, Julie M. Arblaster, and Claudia Tebaldi. “Understanding future patterns of increased precipitation intensity in climate model situations.” *Geophysical Research Letters* 32 (September 2005).

Gilmore, Kevin P., Marcia J. Tate, Mark L. Chenault, Bonnie Clark, Terri McBridge, and Margaret Wood. *Colorado Prehistory: A Context for the Platte River Basin*. Denver: Colorado Council of Professional Archaeologists, 1999.

Glassberg, David. “Place, Memory, and Climate Change.” *The Public Historian* 36 (August 2014): 17-30.

Gorsuch, Anne E. *All This is Your World: Soviet Tourism at Home and Abroad after Stalin*. New York: Oxford University Press, 2011.

Gottlieb, Robert. *Forcing the Spring: The Transformation of the American Environmental Movement*. Washington, D.C.: Island Press, 2005.

Goudie, Andrew S. *The Human Impact of the Natural Environment: Past, Present, and Future*. New York: Wiley-Blackwell, 2013.

Grayson, Lawrence P. “A Brief History of Engineering Education in the United States.” *IEEE Transactions of Aerospace and Electronic Systems* 16 (May 1980): 373-92.

Grübler, Arnulf. *Technology and Global Change*. Cambridge, UK: Cambridge University Press, 1998.

Guidoboni, Emanuela. “Human Factors, Extreme Events and Floods in the Lower Po Plain (Northern Italy) in the 16th Century.” *Environment and History* 4 (1998): 279-308.

Guldi, Jo, and David Armitage. *The History Manifesto*. Cambridge, UK: Cambridge University Press, 2014.

Haddock, Keith. *The Earthmover Encyclopedia*. St. Paul, MN: Motorbooks International, 2002.

Haff, P.K. “Hillslopes, rivers, plows, and trucks: mass transport of the Earth’s surface by natural and technological processes.” *Earth Surface Processes and Landforms* 35 (August 2010): 1157-66.

Hall, Alexander. “The North Sea Flood of 1953.” *Arcadia: Environment & Society Portal* 5 (2013), http://www.environmentandsociety.org/node/5181 (Accessed on 19 March 2016).

Halverson, Anders. *An Entirely Synthetic Fish: How Rainbow Trout Beguiled America and Overran the World.* New Haven, CT: Yale University Press, 2010.

Hämäläinen, Pekka. “The Rise and Fall of Plains Indian Horse Cultures.” *Journal of American History* 90 (December 2003): 833-62.

Hamilton, Clive, Christophe Bonneuil, and François Gemenne, editors. *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*. New York: Routledge, 2015.

Hamilton, Clive. *Earthmasters: The Dawn of the Age of Climate Engineering*. New Haven, CT: Yale University Press, 2013.

Hayden, Dolores. *Building Suburbia: Green Fields and Urban Growth, 1820-2000*. New York: Pantheon, 2003.

Hays, Samuel P. *Health, Beauty, and Permanence: Environmental Politics in the United States, 1955-1985.* New York: Cambridge University Press, 1987.

Herod, Andrew. *Scale*. New York: Routledge, 2011.

Herzog, Lawrence A. *Global Suburbs: Urban Sprawl from the Rio Grande to Rio de Janeiro*. New York: Routledge, 2015.

Hines, Sarah. “Our Relationship with a Dynamic Landscape: Understanding the 2013 Northern Colorado Flood.” *Science You Can Use Bulletin*, United States Forest Service, March-April 2014, http://www.fs.fed.us/rm/science-application-integration/docs/science-you-can-use/2014-03.pdf (accessed on 26 March 2015).

Hirt, Paul. *A Conspiracy of Optimism: Management of the National Forests Since World War Two.* Lincoln: University of Nebraska Press, 1994.

Hoag, Heather J. *Developing the Rivers of East and West Africa: An Environmental History.* New York: Bloomsbury Press, 2013.

Hoerling, Martin, Klaus Wolter, Judith Perlwitz, Xiaowei Quan, Jon Eischeid, Hailan Wang, Siegfried Schubert, Henry Diaz, and Randall Dole. "Northeast Colorado Extreme Rains Interpreted in a Climate Change Context." *Bulletin of the American Meteorlogical Society* 95 (September 2014): 15-18, http://journals.ametsoc.org/doi/pdf/10.1175/ 1520-0477-95.9.S1.1 (accessed on 26 March 2015).

Holden, Joseph, editor. *Water Resources: An Integrated Approach.* New York: Routledge, 2014.

Holling, C.S., and Gary K. Meffe. "Command and Control and the Pathology of Natural Resource Management." *Conservation Biology* 10 (April 1996): 328-37.

Hooke, Roger LeB. "On the efficacy of humans as geomorphic agents." *GSA [Geological Society of America] Today* 4 (September 1994): 224-25.

————. "On the history of humans as geomorphic agents." *Geology* 28 (September 2000): 843-46.

Hornborg, Alf. "The political ecology of the Technocene: uncovering ecologically unequal exchange in the world-system." In *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, edited by Clive Hamilton, Christophe Bonneuil, and François Gemenne. New York: Routledge, 2015.

Howe, Joshua P. *Behind the Curve: Science and the Politics of Global Warming*. Seattle: University of Washington Press, 2014.

Howkins, Adrian. "Experiments in the Anthropocene: Climate Change and History in the McMurdo Dry Valleys, Antarctica." *Environmental History* 19 (April 2014): 294-302.

Hughes, Thomas P. "Technological Momentum in History: Hydrogenation in Germany 1898-1933," *Past & Present* 44 (August 1969): 106-32.

————. *Human-Built World: How to Think about Technology and Culture.* Chicago: University of Chicago Press, 2004.

————. *Networks of Power: Electrification in Western Society, 1880-1930*. Baltimore: Johns Hopkins University Press, 1983.

Hunt, Lynn. *Writing History in the Global Era*. New York: W. W. Norton & Company, 2014.

Hyde, Anne F. "Cultural Filters: The Significance of Perception in the History of the American West." *Western Historical Quarterly* 24 (August 1993): 351-74.

Jackson, Kenneth T. *Crabgrass Frontier: The Suburbanization of the United States.* New York: Oxford University Press, 1985.

Jarrett, Robert D., and John E. Costa. "1976 Big Thompson Flood, Colorado – Thirty Years Later." U.S. Geological Survey Fact Sheet, July 2006, http://pubs.usgs.gov/fs/2006/3095/pdf/FS06-3095_508.pdf (accessed 12 April 2015).

————. *Evaluation of the Flood Hydrology in the Colorado Front Range Using Precipitation, Streamflow, and Paleoflood Data for the Big Thompson River Basin.* Denver, CO: U.S. Geological Survey, 1988.

Johnson, Bob. *Carbon Nation: Fossil Fuels in the Making of American Culture*. Lawrence: University Press of Kansas, 2014.

Jonsson, Fredrik Albritton. "The Origins of Cornucopianism: A Preliminary Genealogy." *Critical Historical Studies* 35 (Spring 2014): 151-168.

————. "The Industrial Revolution in the Anthropocene." *Journal of Modern History* 84 (2012): 679-96.

Jørgensen, Dolly, Finn Arne Jørgensen, and Sara B. Pritchard, editors. *New Natures: Joining Environmental History with Science and Technology Studies*. Pittsburgh, PA: University of Pittsburgh Press, 2013.

Josephson, Paul R. *Industrialized Nature: Brute Force Technology and the Transformation of the Natural World*. Washington, D.C.: Island Press, 2002.

Karl, Thomas R., and Richard W. Knight, "Secular Trends of Precipitation Amount, Frequency, and Intensity in the United States." *Bulletin of the American Meteorological Society* 79 (February 1998): 231-41.

Katznelson, Ira. *Fear Itself: The New Deal and the Origins of Our Time*. New York: W.W. Norton & Company, 2013.

Kelman, Ari. *A Misplaced Massacre: Struggling over the Memory of Sand Creek*. Cambridge, MA: Harvard University Press, 2013.

————. *A River and Its City: The Nature of Landscape in New Orleans*. Berkeley: University of California Press, 2003.

Kevin E. Trenberth, Philip D. Jones, Peter Ambenje, Roxana Bojariu, David Easterling, Albert Klein Tank, David Parker, Fatemeh Rahimzadeh, James A. Renwick, Matilde Rusticucci, Brian Soden, and Panmao Zhai. "Observations: Surface and Atmospheric Climate Change." In *Climate Change 2007: The Physical Science Basis*, Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, edited by S.D. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller. New York: Cambridge University Press, 2007.

Klein, Naomi. *The Shock Doctrine: The Rise of Disaster Capitalism.* New York: Metropolitan Books, 2007.

Knox, James C. “Large increase in flood magnitude in response to modest changes in climate.” *Nature* 361 (February 1993): 430-32.

————. “Sensitivity of modern and Holocene floods to climate change.” *Quaternary Science Reviews* 19 (January 2000): 439-57.

Koenker, Diane P. *Club Red: Vacation Travel and the Soviet Dream.* Ithaca, NY: Cornell University Press, 2013.

Kolbert, Elizabeth. “Enter the Anthropocene—the Age of Man.” *National Geographic*, March 2011, http://ngm.nationalgeographic.com/2011/03/age-of-man/kolbert-text/1 (accessed 1 July 2014).

————. *The Sixth Extinction: An Unnatural History*. New York: Henry Holt and Company, 2014.

Krendel, Ezra S. “Muscle-Generated Power.” In *Marks’ Standard Handbook for Mechanical Engineers*, 11th edition, edited by Eugene A. Avallone, Theodore Baumeister III, and Ali M. Sadegh. New York: McGraw-Hill Publishers, 2006.

Kroh, Kiley. “After the Flood: How Climate Change Changed One Colorado Community Forever.” *Climate Progress*, 10 October 2013, http://thinkprogress.org/climate/2013/10/10/2741901/colorado-flood-fire/ (accessed on 26 March 2015).

Latour, Bruno. *We Have Never Been Modern*, trans. Catherine Porter. Cambridge, MA: Harvard University Press, 1993.

LeCain, Timothy J. *Mass Destruction: The Men and Giant Mines that Wired America and Scarred the Planet*. New Brunswick, NJ: Rutgers University Press, 2009.

————. “Against the Anthropocene: A Neo-Materialist Perspective.” *International Journal for History, Culture, and Modernity* 3 (2015): 1-24.

Lefebvre, Henri. *The Production of Space*, translated by Donald Nicholson-Smith. 1974; Oxford, UK: Basil Blackwell, 1991.

Lippard, Lucy R. *The Lure of the Local: Senses of Place in a Multicentered Society*. New York: The New Press, 1997.

Louter, David. *Windshield Wilderness: Cars, Roads, and Nature in Washington's National Parks*. Seattle: University of Washington Press, 2006.

Lundgreen, Peter. "Engineering Education in Europe and the U.S.A., 1750-1930: The Rise to Dominance of School Culture and Engineering Professions." *Annals of Science* 47 (1990): 33-75.

Lury, Celia. *Consumer Culture*, Second Edition. New Brunswick, NJ: Rutgers University Press, 2011.

Mahoney, James. "Path dependence in historical sociology." *Theory and Society* 29 (August 2000): 507-48.

Malm, Andreas, and Alf Hornborg. "A geology of mankind?: A critique of the Anthropocene narrative." *The Anthropocene Review* 1 (April 2014): 62-69.

Malm, Andreas. "The Anthropocene Myth: Blaming all of humanity for climate change lets capitalism off the hook." *Jacobin Magazine*, 30 March 2015, https://www.jacobinmag.com/2015/03/anthropocene-capitalism-climate-change/ (accessed on 31 May 2015).

May, Elaine Tyler. *Homeward Bound: American Families in the Cold War Era*. New York: Basic Books, 1988.

McCarthy, Tom. *Auto Mania: Cars, Consumers, and the Environment.* New Haven, CT: Yale University Press, 2007.

McComb, David. *Big Thompson: Profile of a Natural Disaster* Boulder, CO: Pruett Publishing, 1980.

McEvoy, Arthur F. "Toward an Interactive Theory of Nature and Culture: Ecology, Production, and Cognition in the California Fishing Industry." *Environmental Review* 11 (Winter 1987): 289-305.

McNeill, J.R., and Peter Engelke. *The Great Acceleration: An Environmental History of the Anthropocene since 1945*. Cambridge, MA: Harvard University Press, 2016.

McNeill, J.R. *Something New under the Sun: An Environmental History of the Twentieth-Century World*. New York: W.W. Norton & Company, 2000.

McPhee, John. *The Control of Nature*. New York: Farrar, Straus, & Giroux, 1989.

Meldahl, Keith Heyer. *Rough-Hewn Land: A Geologic Journey from California to the Rocky Mountains*. Los Angeles: University of California Press, 2011.

Melosi, Martin V. “Path Dependence and Urban History: Is a Marriage Possible?” In *Resources of the City: Contributions to an Environmental History of Modern Europe*, edited by Dieter Schott, Bill Luckin, and Genevieve Massard-Guilbaud Aldershot: Ashgate, 2005.

Miller, Daegan. “The Anthropocene Slam: A Cabinet of Curiosities.” Nelson Institute Center for Culture, History, and Environment, University of Wisconsin-Madison, 8-10 November 2014, http://nelson.wisc.edu/che/anthroslam/schedule/index.php (accessed on 31 May 2015).

Milly, P.C.D., R. T. Wetherald, K. A. Dunne, and T. L. Delworth. “Increasing risk of great floods in a changing climate.” *Nature* 415 (January 2002): 514-17.

Min, Seung-Ki, Xuebin Zhang, Francis W. Zwiers, and Gabriele C. Hegerl. “Human contribution to more-intense precipitation extremes.” *Nature* 470 (February 2011): 378-81.

Minteer, Ben A., and Stephen J. Pyne, editors. *After Preservation: Saving American Nature in the Age of Humans*. Chicago: University of Chicago Press, 2015.

Mitchell, Timothy. *Carbon Democracy: Political Power in the Age of Oil*. New York: Verso, 2011.

Mitchell, Timothy. *Rule of Experts: Egypt, Techno-Politics, Modernity*. Berkeley: University of California Press, 2002.

Molina, Mario, James McCarthy, Diana Wall, Richard Alley, Kim Cobb, Julia Cole, Sarah Das, Noah Diffenbaugh, Kerry Emanuel, Howard Frumkin, Katharine Hayhoe, Camille Parmesan, and Marshall Shepherd. *What We Know: The Reality, Risks, and Response to Climate Change*. Washington, D.C.: American Association for the Advancement of Science, 2014. http://whatweknow.aaas.org/wp-content/uploads/2014/07/whatweknow_website.pdf (accessed on 23 September 2015).

Moranda, Scott. *The People’s Own Landscape: Nature, Tourism, and Dictatorship in East Germany*. Ann Arbor: University of Michigan Press, 2014.

Mosley, Stephen. *The Chimney of the World: A History of Smoke Pollution in Victorian and Edwardian Manchester*. New York: Routledge, 2008.

Naiman, Robert J., and Henri Decamps. “Ecology of Interfaces: Riparian Zones.” *Annual Review of Ecology and Systematics* 28 (1997): 621-58.

Nash, Linda. “The Agency of Nature or the Nature of Agency.” *Environmental History* 10 (January 2005): 67-69.

Nicolaides Becky M., and Andrew Wiese, editors. *The Suburb Reader*. New York: Routledge, 2006.

Nikiforuk, Andrew. *The Energy of Slaves: Oil and the New Servitude*. Vancouver, BC: Greystone Books, 2012.

Nir, Dov. *Man, A Geomorphological Agent: An Introduction to Anthropic Geomorphology*. Boston: D. Reidel Publishing, 1983.

Noble, David F. *America By Design: Science, Technology, and the Rise of Corporate Capitalism*. New York: Alfred A. Knopf, 1977.

O'Neill, Karen M. *Rivers by Design: State Power and the Origins of U.S. Flood Control*. Durham, NC: Duke University Press, 2006.

Oliver-Smith, Anthony, and Susanna M. Hoffman, editors. *The Angry Earth: Disaster in Anthropological Perspective*. New York: Routledge, 1999.

Olsen, J. Rolf. "Climate Change and Floodplain Management in the United States." *Climatic Change* 76 (June 2006): 407-26.

Oreskes, Naomi, and Erik M. Conway. "Challenging Knowledge: How Climate Science Became a Victim of the Cold War." In *Agnotology: The Making and Unmaking of Ignorance*, edited by Robert Proctor and Londa Schiebinger. Stanford, CA: Stanford University Press, 2008.

————. *The Collapse of Western Civilization: A View from the Future*. New York: Columbia University Press, 2014.

Orlemann, Eric C. *Caterpillar Chronicle: The History of the World's Greatest Earthmovers*. Minneapolis, MN: Motorbooks International, 2009.

Orsi, Jared. *Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles*. Los Angeles: University of California Press, 2004.

Page, John S. *Estimator's Equipment Installation Man-Hour Manual*, Third Edition. Houston, TX: Gulf Publishing Company, 1999.

Palmer, T.N., and J. Räisänen. "Quantifying the risk of extreme seasonal precipitation events in a changing climate." *Nature* 415 (January 2002): 512-14.

Patterson, James T. *Grand Expectations: The United States, 1945-1974*. New York: Oxford University Press, 1996.

Pearce, Fred. *With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change*. Boston: Beacon Press, 2007.

Perrow, Charles. *Normal Accidents: Living with High-Risk Technologies*. New York: Basic Books, 1984.

Perry, Charles A. "Significant Floods in the United States During the 20$^{th}$ Century—USGS Measures a Century of Floods." U.S. Geological Survey Fact Sheet, March 2000, http://pubs.usgs.gov/fs/2000/0024/report.pdf (accessed on 12 April 2015).

Philpott, William. "Stand by Your Brand: Vail, Colorado, and the Consumer Roots of Popular Environmentalism." In *Cities and Nature in the American West*. Edited by Char Miller. Reno: University of Nevada Press, 2010.

————. *Vacationland: Tourism and Environment in Colorado's High Country*. Seattle: University of Washington Press, 2013.

Pickering, James H. *America's Switzerland: Estes Park and Rocky Mountain National Park, the Growth Years.* Boulder: University Press of Colorado, 2005.

Pritchard, Sara B. *Confluence: The Nature of Technology and the Remaking of the Rhône*. Cambridge, MA: Harvard University Press, 2011.

Pyne, Stephen J. *Voice & Vision: A Guide to Writing History and Other Serious Nonfiction*. Cambridge, MA: Harvard University Press, 2009.

Rae, John, and Rudi Volti. *The Engineer in History*, Revised Edition. New York: Peter Lang Publishing, 2001.

Ray, Andrea J., Joseph J. Barsugli, Kristen B. Averyt, Klaus Wolter, Martin Hoerling, Nolan Doesken, Bradley Udall, Robert S. Webb. *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation*. Boulder, CO: Western Water Assessment, 2008.

Reisner, Marc. *Cadillac Desert: The American West and Its Disappearing Water*, Revised Edition. New York: Penguin Books, 1993.

Rennicke, Jeff. *The Rivers of Colorado*. Billings, MT: Falcon Press, 1985.

Robin, Libby, and Will Steffen. "History of the Anthropocene." *History Compass* 5 (2007): 1694-1719.

Robin, Libby. "Histories for Changing Times: Entering the Anthropocene?" *Australian Historical Studies* 44 (2013): 329-40.

Rome, Adam. *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism*. New York: Cambridge University Press, 2001.

Rothman, Hal K. *Devil's Bargains: Tourism in the Twentieth-Century West*. Lawrence: University Press of Kansas, 1998.

————. *The Greening of a Nation?: Environmentalism in the United States since 1945*. New York: Harcourt Brace, 1998.

Ruddiman, William F. "The anthropogenic greenhouse era began thousands of years ago." *Climatic Change* 61 (December 2003): 261-93.

————. *Plows, Plagues, and Petroleum: How Humans Took Control of Climate*, Princeton Library Science Edition. 2005; reprint Princeton, New Jersey: Princeton University Press, 2010.

Santer, D.B., C. Mearsc, F.J. Wentzc, K.E. Taylora, P.J. Glecklera, T.M.L. Wigleyd, T.P. Barnette, J.S. Boylea,W. Brüggemannf, N.P. Gillettg, S.A. Kleina, G.A. Meehld, T. Nozawah, D.W. Piercee, P.A. Stotti, W.M. Washingtond, and M.F. Wehner. "Identification of human-induced changes in atmospheric moisture content." *Proceedings of the National Academy of Sciences* 104 (September 2007): 15248-53, http://sa.indiaenvironmentportal.org.in/files/file/PNAS-2007-Santer-15248-53.pdf (accessed on 17 March 2016).

Schlosser, Eric. *Command and Control: Nuclear Weapons, The Damascus Accident, and the Illusion of Safety*. New York: Penguin Books, 2013.

Scott, James C. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press, 1998.

Shabecoff, Phillip. *A Fierce Green Fire: The American Environmental Movement*, Revised edition. Washington, D.C.: Island Press, 2003.

Sharma, Suhnu Ram. *Vocational Education and Training: History, Methodology, Issues and Perspective*. New Delhi, IN: Mittal Publications, 1994.

Si, Yi. "The World's Most Catastrophic Dam Failures: The August 1975 Collapse of Banqiao and Shimantan Dams." In *The River Dragon Has Come!: The Three Gorges Dam and the Fate of China's Yangtze River and Its People*, compiled by Dai Qing, edited by John G. Thibodeau and Philip B. Williams, translated by Yi Ming. Armonk, NY: M.E. Sharpe, 1998.

Simmons, A.J., K. M. Willett, P. D. Jones, P. W. Thorne, and D. P. Dee. "Low-frequency variations in surface atmospheric humidity, temperature, and precipitation: Inferences from reanalyses and monthly gridded observational data sets." *Journal of Geophysical Research* 115 (2010): 1-21, http://eprints.maynoothuniversity.ie/6535/1/PT_lowfrequency.pdf (accessed on 17 March 2016).

Slaton, Amy E. *Reinforced Concrete and the Modernization of American Building, 1900-1930.* Baltimore: Johns Hopkins University Press, 2001.

Smith, Bruce D., and Melinda A. Zeder. "The onset of the Anthropocene." *The Anthropocene* 4 (June 2013): 8-13.

Stearns, Peter N. *Consumerism in World History: The Global Transformation of Desire*, Second Edition. New York: Routledge, 2006.

Steffen, Will, Angelina Sanderson, Peter Tyson, Jill Jäger, Pamela Matson, Berrien Moore III, Frank Oldfield, Katherine Richardson, John Schellnhuber, B.L. Turner II, and Robert Wasson. *Global Change and the Earth System: A Planet under Pressure*. New York: Springer, 2005.

Steffen, Will, Jacques Grinevald, Paul Crutzen, and John McNeill. "The Anthropocene: conceptual and historical perspectives." *Philosophical Transactions of the Royal Society A* 369 (31 January 2011): 842-67.

Steffen, Will, Paul J. Crutzen, and John R. McNeill. "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?" *AMBIO: A Journal of the Human Environment* 36 (2007): 614-21.

Steinberg, Ted. "Down to Earth: Nature, Agency, and Power in History." *American Historical Review* 107 (June 2002): 798-820.

————. *Acts of God: An Unnatural History of Natural Disasters*. New York: Oxford University Press, 2000.

————. *Down to Earth: Nature's Role in American History*, Third Edition. New York: Oxford University Press, 2013.

Stradling, David, editor. *The Environmental Movement, 1968-1972*. Seattle: University of Washington Press, 2012.

Stromberg, Joseph. "What is the Anthropocene and Are We in It?" *Smithsonian Magazine*, January 2013, http://www.smithsonianmag.com/science-nature/what-is-the-anthropocene-and-are-we-in-it-164801414/?no-ist (accessed 28 June 2014).

Summers, Gregory. *Consuming Nature: Environmentalism in the Fox River Valley, 1850-1950*. Lawrence: University Press of Kansas, 2006.

Sutter, Paul S. "A World with Us: The State of American Environmental History," *Journal of American History* 100 (June 2013): 94-119.

————. *Driven Wild: How the Fight Against Automobiles Launched the Modern Wilderness Movement*. Seattle: University of Washington Press, 2002.

Teisch, Jessica B. *Engineering Nature: Water, Development, and the Global Spread of American Environmental Expertise*. Chapel Hill: University of North Carolina Press, 2011.

Thomas, Julia Adeney. "History and Biology in the Anthropocene: Problems of Scale, Problems of Value." *American Historical Review* 119 (December 2014): 1587-1607.

Tralli, David M., Ronald G. Blom, Victor Zlotnicki, Andrea Donnellan, and Diane L. Evans. "Satellite remote sensing of earthquake, volcano, flood, landslide and coastal inundation hazards." *Journal of Photogrammetry & Remote Sensing* 5 (June 2005): 185-98.

Trouillot, Michel-Rolph. *Silencing the Past: Power and the Production of History*. Boston: Beacon Press, 1995.

Turner, James Morton. *The Promise of Wilderness: American Environmental Politics since 1964*. Seattle: University of Washington Press, 2012.

Tyler, Daniel. *The Last Water Hole in the West: The Colorado-Big Thompson Project and the Northern Colorado Water Conservancy District*. Niwot: University Press of Colorado, 1992.

Van Aalst, Maarten K. "The impacts of climate change on the risk of natural disaster." *Disasters* 30 (March 2006): 5-18.

Vogel, Steven. *Prime Mover: A Natural History of Muscle.* New York: W.W. Norton & Company, 2001.

Webley, Kayla. "Top Ten Historic U.S. Floods." *TIME Magazine*, 11 May 2011, http://content.time.com/time/specials/packages/article/0,28804,2070796_2070798_2070786,00.html (accessed 14 April 2015).

Weil, Benjamin. "The Rivers Come: Colonial Flood Control and Knowledge Systems in the Indus Basin, 1840s-1930s." *Environment and History* 12 (2006): 3-29.

Weisiger, Marsha. *Dreaming of Sheep in Navajo Country*. Seattle: University of Washington Press, 2011.

Wells, Christopher W. *Car Country: An Environmental History*. Seattle: University of Washington Press, 2012.

West, Elliott. *The Contested Plains: Indians, Goldseekers, and the Rush to Colorado*. Lawrence: University Press of Kansas, 1998.

White, Richard. "Nationalization of Nature." *Journal of American History* 86 (December 1999): 976-86.

————. "The Problem with Purity." Tanner Lectures on Human Values, University of California-Davis, 10 May 1999.

————. *Railroaded: The Transcontinentals and the Making of Modern America*. New York: W.W. Norton & Company, 2011.

————. *The Organic Machine: The Remaking of the Columbia River*. New York: Hill and Wang, 1995.

Wilkinson, Bruce H. "Humans as geological agents: A deep time perspective." *Geology* 33 (March 2005): 161-64.

Willet, Katharine M., Philip D. Jones, Nathan P. Gillett, and Peter W. Thorne. "Recent Changes in Surface Humidity: Development of the HadCRUH Dataset." *Journal of Climate* 21 (October 2008): 5364-83, http://eprints.maynoothuniversity.ie/6560/1/PT_recent%20changes%202008.pdf (accessed on 17 March 2016).

Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. *At Risk: Natural Hazards, People's Vulnerability and Disasters*, Second Edition. New York: Routledge, 2004.

Wohl, Ellen E. *Mountain Rivers Revisited*. Washington, D.C.: American Geophysical Union, 2010.

————. *Virtual Rivers: Lessons from the Mountain Rivers of the Colorado Front Range*. New Haven, CT: Yale University Press, 2000.

————. "Human impacts to mountain streams." *Geomorphology* 79 (2006): 217-48.

Worster, Donald. “World Without Borders: The Internationalizing of Environmental History.” *Environmental Review* 6 (Autumn 1982): 8-13.

————. *Dust Bowl: The Southern Plains in the 1930s*. New York: Oxford University Press, 1979.

————. *Rivers of Empire: Water, Aridity, and the Growth of the American West.* New York: Pantheon Books, 1985.

Yogerst, Joseph R. *Long Road South: The Pan-American Highway*. Washington, D.C.: National Geographic Society, 1999.

Zalasiewicz, Jan, Colin N. Waters, Mark Williams, Anthony D. Barnosky, Alejandro Cearreta, Paul Crutzen, Erle Ellis, Michael A. Ellis, Ian J. Fairchild, Jacques Grinevald, Peter K. Haff, Irka Hajdas, Reinhold Leinfelder, John McNeill, Eric O. Odada, Clement Poirier, Daniel Richter, Will Steffen, Colin Summerhayes, James P.M. Syvitski, Davor Vidas, Michael Wagreich, Scott L. Wing, Alexander P. Wolfe, An Zhisheng, Naomi Oreskes. “When did the Anthropocene begin?: A mid-twentieth century boundary is stratigraphically optimal.” *Quaternary International* 30 (January 2015): 196-203.

Zalasiewicz, Jan, Mark Williams, Richard Fortey, Alan Smith, Tiffany L. Barry, Angela L. Coe, Paul R. Bown, Peter F. Rawson, Andrew Gale, Philip Gibbard, F. John Gregory, Mark W. Hounslow, Andrew C. Kerr, Paul Pearson, Robert Knox, John Powell, Colin Waters, John Marshall, Michael Oates, and Philip Stone. “Stratigraphy of the Anthropocene.” *Philosophical Transactions of the Royal Society A* 369 (2011): 1036-55.

Zeller, Thomas. *Driving Germany: The Landscape of the German Autobahn, 1930-1970*, translated by Thomas Dunlap. New York: Berghahn Books, 2007.