

Understanding the Far Reaches of Wyoming Water

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Life as we know it depends on access to fresh water. Unlike sea creatures that thrive in salty oceans, we need access to purified water. As it turns out, clean water is an extremely rare commodity. According to the United States Geological Survey, 96.5 percent of water on Earth resides in oceans and is considered undrinkable. Not only is the remaining 2.5 percent of water critical to our survival, but when it pools on the Earth's surface it creates unimaginable beauty. The water flow patterns during the long periods of Earth's geologic history has created dramatic landscapes that excite men and leave something to be treasured.

In Wyoming, people travel from all over the world to admire the majestic canvases painted by the Teton Range, Bighorn Mountains, Wind River Range and Medicine Bow Mountains. Millions travel to this state to admire the Yellowstone River as it falls over 300 feet before continuing its journey into the Missouri River. Many choose to actually engage nature by rafting down the tumultuous Snake River rapids that eventually end up in the Pacific Ocean.

With the arrival of spring, Wyoming's snowcapped mountains provide the vitality of fresh water essential to streams and rivers throughout the country, as well as fills reservoirs in the most beautiful places of the Continental United States. The rain that falls in the far-reaching valleys and the snowmelt from Wyoming's wondrous peaks travel in almost every direction, providing for dependent residents season after season. Wyoming's water not only sustains life in-state, but it animates land allowing for diversity across the country. Our water travels from the scenic, elevated mountains of Wyoming in almost all directions. The water travels to the west where it meets with the Columbia River and enters the Pacific Ocean. It also travels south through Colorado and Utah meeting up with the Colorado River, and eventually the Gulf of California. Finally, our water runs east, where it departs the state through Nebraska. It contributes to the Missouri River, which eventually ends up in the Gulf of Mexico. As the nomadic water flows out

of Wyoming through rivers and streams, large agricultural communities and thriving cities utilize it along the way.

In the high peaks of the Wind River Mountains stand series of lakes, which many believe are the most beautiful paintings nature herself could create. Beyond the crystal clear reflections of jagged cliffs and towers of rock over 10,000 feet high surrounding the lakes, these bodies of water flow to become the Green River. This powerful river, once snowmelt from Wyoming's peaks, tells a new story in Colorado. Its trek is delayed, dammed up to divert flow for agricultural growth and urban communities. For over millions of years this river has carved away sediment, creating the dramatic, topographic beauty that man established as Canyonlands National Park. The Green River collides with the Colorado River at the bottom of these large sandstone cliffs. The water journeys all the way to the Gulf of California responsible for excavating the Grand Canyon and providing drinking water for the people of Las Vegas along the way.

In the other direction, the North Platte River flows through central Wyoming, where all of the tributaries from the Snowy Range and Laramie Range contribute to the river before taking a turn east and heading into Nebraska. Water usage from this river is critical to neighboring state, Nebraska, whose residents issued a lawsuit against Wyoming claiming that although the majority of water comes from Wyoming, Nebraska deserved the water rights. In *State of Nebraska v. State of Wyoming*, 1945, the Supreme Court determined that Nebraska is justified to 75 percent of the North Platte River's water rights. The court reasoned Nebraska's current farming infrastructure is more fresh water dependent from this river than Wyoming's residents. This decree is still active today. As hydrologists improve on mapping and quantifying the amount of water contributing to the river, the water rights unfortunately, have not changed. Even in 2014,

the state of Wyoming is only allowed to use 25 percent of this water although Wyoming's snow peaked mountains contribute most to the North Platte River.

Due to water rights and other related issues, there is a critical demand for scientists to quantify the amount of water flowing from Wyoming's mountains to other parts of the United States. Research shows that 30 percent of fresh water is in the form of groundwater, which is not being represented in current measurements. The decree giving Nebraska water rights to 75 percent of the North Platte River was not an accurate quantification of the amount of water because it did not account for groundwater. Traditional measurements usually focus on assessing water flowing from a river or stream and not from the ground because in contrast, groundwater is difficult to quantify. In recent efforts, researchers are investigating how water moves through the mountains of Wyoming to better understand how water travels underground. It is important to quantify the amount of water that is leaving the mountains in all ways; on the surface, through rivers and streams, through subsurface flow, and also any remaining water stored in the complex rock formations of the mountains.

Traditionally the way to quantify subsurface flow is to drill holes into the ground measuring the height at which the water rises in the cavity. Drilling is an expensive process and is not ideal. In mountainous rocks such as granite, if the hole misses a fracture the entire cavity or well might appear dry despite water flowing meters away. Another limitation is when the well recharges slowly because only a few small fractures were punctured. Drilling methods can lead to large errors in subsurface water measurement or can change the way the system operates. Current researchers believe geophysical methods can provide innovative, less intrusive ways to measure water flow without drilling holes. Scientists are pushing geophysical methods to the limit in order to quantify the amount of water where it is infiltrating the subsurface.

In order to protect and maintain Wyoming's water, as well as its pristine landscapes, it is important to understand how water moves throughout the high mountains. Studying mountain terrains will help illuminate the journey of Wyoming's water as it travels throughout the United States. Water researchers are currently trying to find new ways to protect, quantify, and preserve water resources over large spatial scales without drilling and disturbing the natural system. Pioneers will invent new tools to find and distribute fresh water to the populace around the world. This can be accomplished if we first understand the long journey of water, starting from the complex mountain terrains, to the winding rivers, where it eventually reaches a cathartic culmination.

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