

# Riffles



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## FALL 2021 FIELD UPDATE

# SOLUTIONS FOR A WARMING WATERSHED

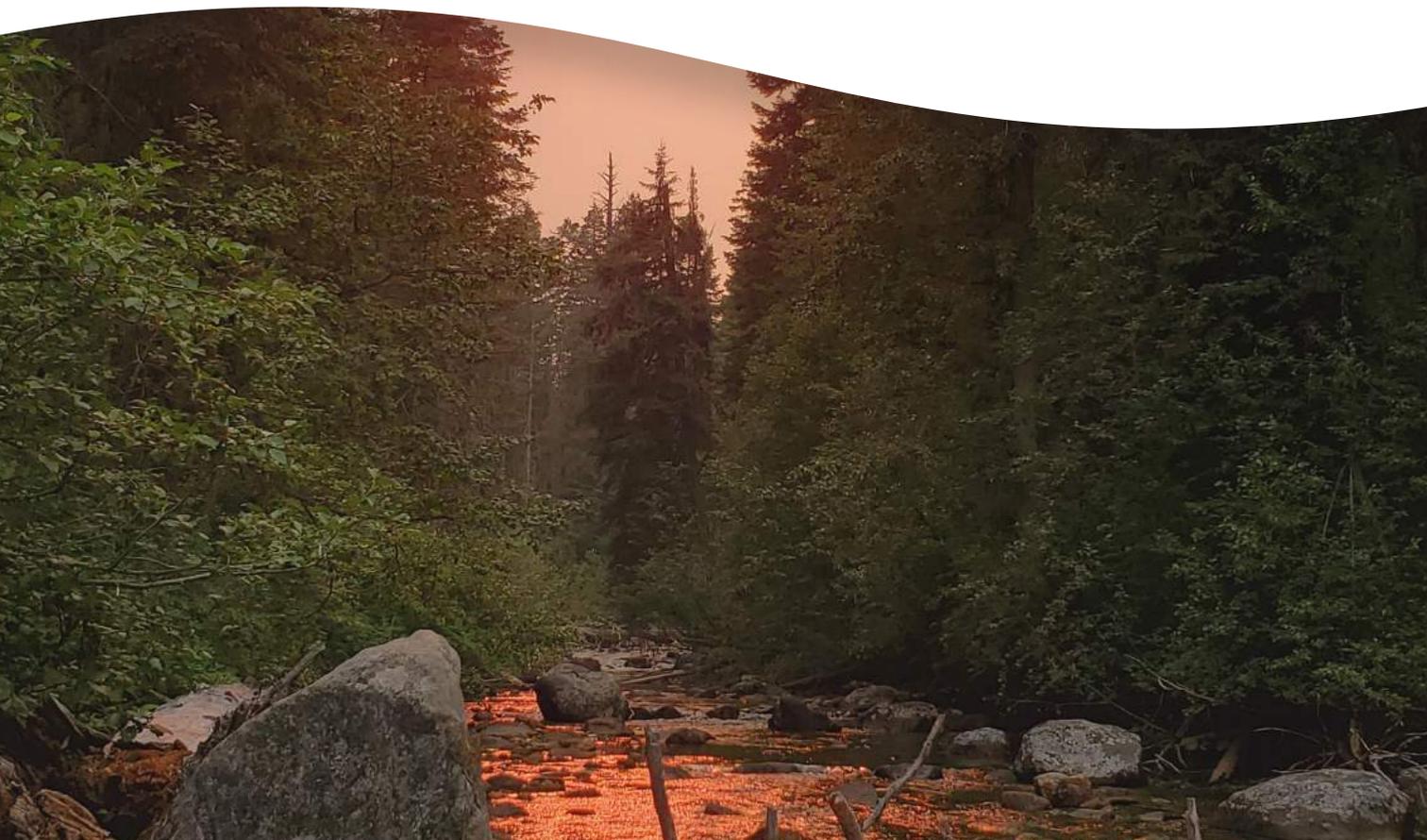
*Stop us if you've heard this one before: Montana's 2021 drought and blistering July rewrote the record books. Sound familiar? We also broke records in 2017, 2013, 2007, 2000, and 1988. And while we've heard the warnings for decades, this summer's withering weather put a white hot spotlight on how climate change is increasing the severity of extreme weather events and exacerbating the impacts on rivers, people, and wildlife. Greater awareness of climate change is welcome. But it doesn't bring immediate relief from ominous heat domes and persistent drought. The good news is we do have effective tools and strategies to help a warming watershed.*

## 2021: ABNORMAL OR NEW NORMAL?

No newsflash here: conditions were dismal on our rivers this summer as severe drought bore down on the region. It kicked off with a warm winter and mediocre snowpack, followed by an early-season heat wave in May-June that ranks among the driest in this region's recorded history. That set up rivers and streams to be pushed to the brink by early summer, with the Upper Clark Fork and southwest Montana bearing the brunt of the impacts. And then the June-July heat set in – and stayed.

We've had some hot summers, but this one felt like an anomaly. Or is it the new normal under a warming climate? It's likely a mix of both. Let's look at the data, viewed through the lens of the water cycle.

**SNOWPACK:** Despite a La Niña winter, which is associated with wetter conditions, western Montana had a wonky snowfall season. Cycles of heavy snowfall (October and February) were punctuated by extremely dry periods (January and March), making snowpack close to, or in some basins, above normal by winter's end. For example, Snow Water Equivalent (the amount of liquid water



# 2021 HEAT BY THE NUMBERS

**22 DAYS** # OF CONSECUTIVE DAYS OVER 90° IN MISSOULA (6/27 – 7/18); PREVIOUS RECORD: 18 DAYS

**34 DAYS** # OF DAYS BETWEEN 6/27 AND 8/5 (40-DAY SPAN) THAT TEMPS EXCEEDED 90° IN MISSOULA

**44 DAYS** TOTAL # OF DAYS MISSOULA'S HIGH TEMP EXCEEDED 90° IN 2021 (RANK: 3RD; AVG: 23 DAYS)

**88.4°F** AVG. HIGH TEMP JUNE/JULY IN MISSOULA IN 2021 – NEARLY 10° ABOVE NORMAL

**1895** YEAR MONTANA STARTED KEEPING WEATHER RECORDS: JUNE-JULY 2021 WERE WARMEST AND DRIEST MONTHS RECORDED IN THESE 127 YEARS; BREAKS RECORD HELD SINCE 1936

contained in snowpack) was at 93% of normal in the Lower Clark Fork, 101% in the Upper Clark Fork, and an impressive 109% in the Bitterroot as of April first, the date historically used to denote “peak” snowpack.

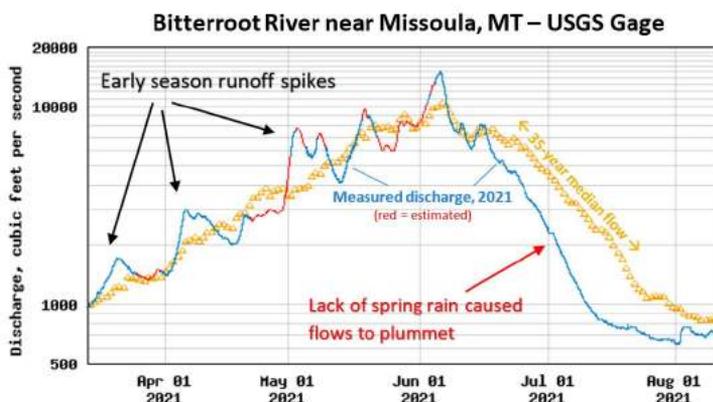
**RUNOFF & FLOWS:** Even with April’s reassuring numbers, the bulk of that snow started melting off earlier than normal this year, especially at mid & low elevations. In both the Bitterroot and Upper Clark Fork basins several early spring runoff spikes pushed water off early (see graph, right). By mid-May, snowpack had dwindled to just 81% of normal in the Upper Clark Fork and Bitterroot, and 74% in the Lower Clark Fork. With a lack of spring rain to buffer water supplies, streamflows plummeted by late June.

And then came the record-shattering Pacific Northwest Heat Blob of 2021. Intense heat in late June and early July scorched the region for many weeks, reducing parts of the Upper Clark Fork (UCF) to nothing more than a series of pools connected by trickles of warm, algae-clogged water. For those two months, western Montana averaged 1.5 inches of precipitation – 2.5 inches below normal.

By July 31 that combination of searing heat and lack of moisture reduced the UCF near Deer Lodge to just 35 cubic feet per second (cfs) – about 40% of average for that date, and its lowest reading since the fire-ravaged summer of 2000. By comparison, in early June the river was flowing at more than 600 cfs at that location. On July 28 we measured flow rates in the single digits on the upper river’s pinch points: 9.8 cfs at Racetrack Bridge, and a scant 7.7 cfs at Sager Lane. How low is that? Barely enough water to get your ankles wet (see photo on p.3).

Fortunately, not all basins experienced such devastatingly low flows, thanks to better snowpack, less demand, and other variables. The Blackfoot, Flathead, Rock Creek, and Upper Bitterroot generally bucked statewide trends and did not plummet to crisis levels.

**AIR TEMPERATURES:** This summer’s incredible heat across the West is being compared to the Dust Bowl drought of the 1930s and, in Montana, the heat wave of July 2007, when Missoula



recorded its all-time high temperature of 107°F. These extremely warm temperatures have been the main drivers of this year’s intense drought, and they were indeed record-breakers (see above).

**WATER TEMPERATURES:** Disappearing snowpack. Dismal stream flows. Early, extreme, and lingering heat. By early summer conditions were already dire for trout and aquatic life. In many places this 1, 2, 3 punch caused water temperatures to exceed 70°F for extended periods of time, with some reaches soaring to the mid-70s and higher. At these temperatures trout mortality climbs and overall fish populations are threatened.

What made 2021 especially difficult is these temperatures were sustained over time. In the Upper Clark Fork water temps remained at detrimental levels from mid-June through early August and even stayed high overnight. During peak heat, nighttime water temps barely dropped into the mid-60s in many places. In these conditions, fish don’t just suffer for a day or two: impacts are cumulative. Montana’s fish spent a lot of time in 60 and 70-degree water this year, giving them no chance to recover.

**THE ELEPHANT IN THE ROOM:** We’ve heard the warnings and projections for decades. If nothing else, in 2021 the climate elephant in the world’s collective living room became visible to a lot more people. And while climate change doesn’t cause droughts, global temperature increases do aggravate their intensity, severity,



CLARK FORK RIVER NEAR SAGER LANE IN THE DEER LODGE VALLEY ON JULY 28, 2021

aggravate their intensity, severity, and duration. In fact, one of the major findings of the 2017 Montana Climate Assessment (MCA) is that climate change and rising temperatures will reduce snowpack and shift historical patterns of streamflow in Montana, resulting in additional stress on water supplies. Of particular resonance this year, the MCA found that “rising temperatures will likely exacerbate drought when and where it occurs.” Hello, summer of 2021.

Unfortunately, the summer of 2021 (and other record-setting summers) may be seen as bellwethers for future conditions. Whether we call that “abnormal” or a “new normal” doesn’t change the impacts and implications for the Clark Fork watershed. Add to these stressors pollution, legacy mine and mill wastes, rapid population growth, and demand that often exceeds supply, and the need for action is clear.

## LOW FLOW FIXES

Montana Fish, Wildlife and Parks estimates that more than 900 miles of waterways in the Clark Fork basin are either chronically dewatered (occurring in virtually all years), or periodically dewatered (dewatered in low flow or drought years). That means that even if the 2021 drought were not “one for the record books,” hundreds of miles of streams are already in need of reliable, long-term solutions. By embracing and advancing those solutions, we ensure that when extreme conditions inevitably arrive, our watershed – and the communities, fish, and wildlife it sustains – is far more prepared and better able to absorb the impacts.

The basic fixes are pretty simple: Keep more water instream and use water smarter. But low flow challenges also require a diverse, strategic, 360-degree approach to the problem:

# FISHING DURING DROUGHT: THE RULE OF THREE

Low water means warm water, and warm water means trouble for trout. As cold-blooded species, trout have difficulty thermoregulating when water temperatures are elevated. Warm water also holds less dissolved oxygen, making it harder for fish to “breathe.” Further, impacts are cumulative, so a one-day drop in water temps doesn’t erase the stress from weeks or months of swimming in bathwater.

In general, trout get stressed when water temps exceed 68°F, though Montana’s native trout need it even cooler: bull trout, for example, do best at 59°F or below.

As an angler, it’s important for you to know that even if a released fish swims off, it does not necessarily mean all is well. More than 90% of catch-and-release mortality occurs after the fish swims away. How can you decrease fish stress and mortality when water temps spike? Follow the Rule of Three:



### 1. CARRY A THERMOMETER

Over 68, fishing can wait! Don’t have one? See enclosed offer.



### 2. KEEP THEM WET

A fish can suffer serious long-term effects after just 10-20 seconds out of the water. One study showed 72% mortality in rainbow trout after 60 seconds out of the water. Consider skipping the photo op and just remove hooks in the water.



### 3. PROTECT THE SLIME

A fish’s slime is its immune system. To protect it, wet your hands before you handle fish – every time.



## KEEPING MORE WATER INSTREAM

**WATER LEASES AND ACQUISITIONS:** No one “owns” water in Montana. Rather, people and entities hold, or own, the right to put water to “beneficial use,” including use for instream flow. Because this is such an effective way to help thirsty creeks, in 2003 CFC began purchasing and holding water rights (we are currently the only nonprofit entity in the state that holds a portfolio of owned instream flow water rights). We also began negotiating voluntary leases with other water users. These two strategies enable us to keep billions of gallons of water flowing in dozens of streams across the basin each summer. In 2021 we managed 34 rights (that preserve 4 billion gallons instream), which includes bi-weekly monitoring through the summer to keep tabs on stream vital signs and to ensure that the water that’s supposed to be there is really there.

**GOING BIG:** A water lease can make or break a small, struggling stream, but dewatering of a mainstem river requires solutions that deliver much larger volumes of water, and that can be implemented quickly when flows plummet. One answer could be targeted, large-scale, short-term water leases with irrigators who have significant water rights. It’s worked in neighboring states, so CFC and a cadre of partners have launched a pilot project in the Upper Clark Fork to explore how it could work here. A short-term lease allows producers to irrigate in spring when water is plentiful, then receive payment to forego irrigation in late season, or during periods of low flow or drought. We believe combining and scaling multiple, strategically-targeted short-term leases holds real promise as a way to provide enough water to tackle the chronic dewatering problems plaguing the UCF.

**HEADWATERS STORAGE:** In the right basins and under the right circumstances, natural and constructed alpine reservoirs can be an

excellent source of life-saving water for hard-hit creeks. CFC owns storage water rights on two headwaters lakes in the Clark Fork basin and has been working to secure legal authority to release that flow when it’s needed most. We’re also looking at other basins where headwaters storage might be an option. Painted Rocks Reservoir in the upper Bitterroot, with its 25,000 acre-feet of stored water, is an excellent example of the power of this strategy: releases from this reservoir are the lifeblood of the Bitterroot River each summer. Similarly, in August 2021 Butte Silver Bow, Montana Resources, and the Montana Natural Resource Damage Program crafted an agreement to release water from Silver Lake (near Anaconda), which proved to be a lifesaver for the Upper Clark Fork River at those pinch points noted above (see photo below).

**BEAVER:** Where there’s beaver, there’s water. From building ponds and expanding wetlands, to increasing water storage, slowing runoff, and helping forests withstand catastrophic wildfire, they can be a thirsty stream’s best friend – though a land manager’s worst enemy. To expand beaver-related benefits for at-risk waterways we’re working with partners on field studies and data collection to track past, current, and potential future beaver habitat; installing Beaver Dam Analogs to attract beaver to locations where they could benefit stream health; and, in collaboration with National Wildlife Federation and Defenders of Wildlife, implementing non-lethal beaver management projects in select areas through a program aimed at reducing beaver-human conflicts.

## MAKING EVERY DROP COUNT

**INFRASTRUCTURE UPGRADES:** The Clark Fork watershed is laced with thousands of miles of irrigation ditches and countless structures that divert water into those ditches. Improving the efficiency of these systems can conserve a surprising amount of water, which improves stream health while also saving time and



CLARK FORK RIVER NEAR SAGER LANE ON AUG. 12, 2021, AFTER RELEASE OF SILVER LAKE WATER



THIS ROCK “FISH LADDER” ON BAGGS CREEK IN THE UCF NEAR ITS CONFLUENCE WITH COTTONWOOD CREEK IS PART OF A LARGER PROJECT THAT INCLUDED A FISH SCREEN INSTALLATION, PLUS A DIVERSION, HEADGATE, AND CANAL UPGRADE. THE PROJECT ELIMINATED AN ENTRAINMENT RISK AND RESTORED ACCESS TO SPAWNING HABITAT AND COOL HEADWATERS REFUGE FOR A CONSERVATION POPULATION OF NATIVE WESTSLOPE CUTTHROAT TROUT.

money for ranchers. We work with willing landowners and irrigation districts on projects such as diversion upgrades, ditch-piping, syphons, channel and ditch reconfiguration, and conversion from flood to pivot irrigation. Thanks to the cooperation of these private irrigators, over the last decade we’ve completed dozens of these projects across the basin, which have combined to add billions of gallons of water to the mainstem Clark Fork and many tributaries.

**HABITAT IMPROVEMENT:** Extreme heat and persistent drought take a big toll, but stream health and ecological condition go a long way to mitigate the impacts. Many waterways in the Clark Fork basin suffer from insufficient shade, erosion, widened, trampled, or incised banks, excessive sediment, and other impairments that undermine their resilience.

We work with a wide diversity of partners on projects that boost stream health. Examples include restoring riparian vegetation, planting trees and shrubs, re-naturalizing banks and creek channels, increasing complexity of aquatic habitat (such as adding wood to create pools, shade, and cover), installing fencing and stock tanks to keep cattle out of creeks, installing catchments to keep roadway sediment from reaching streams, and other treatments. Enhancements like these help improve water quality, lower water temperatures, restore natural function, and decrease water loss from evaporation, while also improving instream habitat so that aquatic species have access to cleaner, cooler water when temperatures climb (see photo above).

## THE CHANGING ROLE OF SNOWPACK

In 2017 and 2021 the Clark Fork and Bitterroot basins were at 100% of normal snowpack on April first. Yet both were extreme drought years. What gives?

Persistent drought has long been a natural part of Montana’s climate. But the 2017 Montana Climate Assessment notes that rising global temperatures will both exacerbate these droughts (impacting timing and severity), as well as increase streamflows in winter and spring.

Warmer, wetter springs mean earlier snowmelt and runoff. That, in turn, means streams fall to baseflow conditions sooner. In this scenario, winter snowpack lessens as a driver of summer streamflows as that influence shifts toward precipitation that falls in spring and early summer (often as rain).

**UPSHOT:** Focus on strategies to hold on to that early season water. We’ll take all the snowpack we can get, but the smart money is on storage and conservation.

## GOING THE FULL 360

Instream and on-the-ground projects are essential to helping a warming watershed, but they cannot succeed on their own. This complex problem requires layered, diverse, and integrated strategies to bolster work in the field, provide back-up when other fixes fail or fall short, and ensure long-term, system-wide resilience. Approaching low flow challenges holistically also means thinking about both long- and short-term needs, tackling social, economic, political, and procedural obstacles, and ensuring *quality* of water conserved is given as much consideration as *quantity*. After all, if we conserve water for instream flow, but it's too unhealthy to support aquatic life, what have we gained?

Our “flow 360” approach includes strategies such as removing mine waste; limiting nutrient pollution; removing barriers so fish can reach cooler upstream water; improving management practices on lands adjacent to sensitive waterways; preventing new contamination; ensuring people are informed about watershed needs and actively engaged in river stewardship; and

ensuring policies and practices help, not harm, water resources (see box below).

The coming of fall, with its cool nights and smoke-free skies, is welcome relief from the hot, searing summer of 2021. The heat dome is gone, there's snow in the high country, and word has it La Niña's making a comeback. Are we looking at drought-busting blizzards? Or are we in for another wonky winter?

No matter what's ahead, the Clark Fork watershed will still need our help. Long before this year's severe drought and crazy heat, hundreds of miles of streams were struggling from the impacts of a changing climate. In just the last five years the watershed has seesawed from extreme droughts (2016 and 2017) to flooding (2018 and 2019) and back again (2021). The keys for this warming – and wonky – watershed are resilience and creative problem-solving, and, most importantly, people like you, who make solutions possible, and keep a hard-working Clark Fork flowing clean, cold, and healthy.

## HELP, NOT HARM: CFC'S POLICY RECOMMENDATIONS

Despite the Clark Fork basin's propensity for drought, we are facing some truly remarkable challenges, aggravated by a quickly-warming climate. Unfortunately, Montana's water policies and tools haven't kept pace. What's needed now?

**1. REFORM THE OLD:** Montana's private water leasing statute has been highly successful in restoring flows in key tributaries. But it's an onerous and expensive bureaucratic nightmare that can take years to complete, deterring willing landowners from participating. *Reform and streamline the process to increase efficiency and encourage landowner buy-in.*

**2. FUND THE NEW:** Montana's current water leasing program lacks the flexibility and efficiency to address acute drought impacts. Short-term water leasing (which neighboring states have implemented) can fill the gap by using temporary or seasonal leases to restore instream flows. *Fully fund the Upper Clark Fork short-term leasing pilot project to get this powerful tool in play.*

**3. DON'T FORGET THE GROUNDWATER:** In the old days developers could drill an unlimited number wells for residential use without any permits or analysis of impacts on others water users or nearby waters. CFC closed this loophole, but developers have found new ways to exploit this permit-free path to water. *Regulate and mitigate groundwater use to preserve our aquifers and the streams that they feed.*

