Watershed Days BioBlitz 2019

LEFT HAND
watershed center

LEFT HAND WATERSHED CENTER
6800 Nimbus Road, Longmont CO 80503 (office)
P.O. Box 1074, Niwot, CO 80544-0210 (mailing)
303.530.4200 | www.watershed.center

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Why Care For Your Watershed?

When you are asked, “where are you from?” what if your answer was your watershed? Front Range Colorado is a mosaic of urban, mountain, agricultural, ranching, and rural communities. Despite their differences, it’s a watershed that unites them all. In the northern Front Range, we are all part of the South Platte Basin. As you navigate upstream, you become more localized to smaller sub-basins and watersheds. Yet, we are still all connected downstream.

Not only do watersheds connect us, but we all rely on their services as natural filters to provide clean water. Annual precipitation, especially snowfall, is our main source of water. From headwaters to plains, our water filters through mixed forests and grasslands or agricultural fields. Our water flows down rooftops and over parking lots. Eventually it drains into our creeks, bringing with it bits and pieces of the land it came from. Our watershed’s ability to filter out harmful substances depends on resilience, or its ability to accommodate changing conditions or recover from dramatic events.

Given that these challenges are becoming more common with climate change, how can we ensure our watershed’s resilience? All of us play an important role in caring for our watershed, and one way to improve resilience is by using science to monitor the health status of our watershed. By leveraging our entire community, we can collect scientific data at a large scale that would not be otherwise achievable. These community-powered large-scale data collection efforts help us know our watersheds better, and in turn, help us do more to restore and protect them.

What We Did

In 2019 our community came together to assess the health of our watersheds by collecting scientific data across four Front Range watersheds on one day – otherwise known as a bio-blitz. This was the inaugural Front Range Watershed Days event for Left Hand Watershed Center and our partners. Participants, including both community members and scientists, collected data about three important watershed health indicators: pool habitat, percent sands, and aquatic bugs. Data were collected across four different watersheds: Fourmile, Left Hand, St. Vrain, and Big Thompson. Below is a figure of all the surveyed watersheds and sample sites (Figure 1).

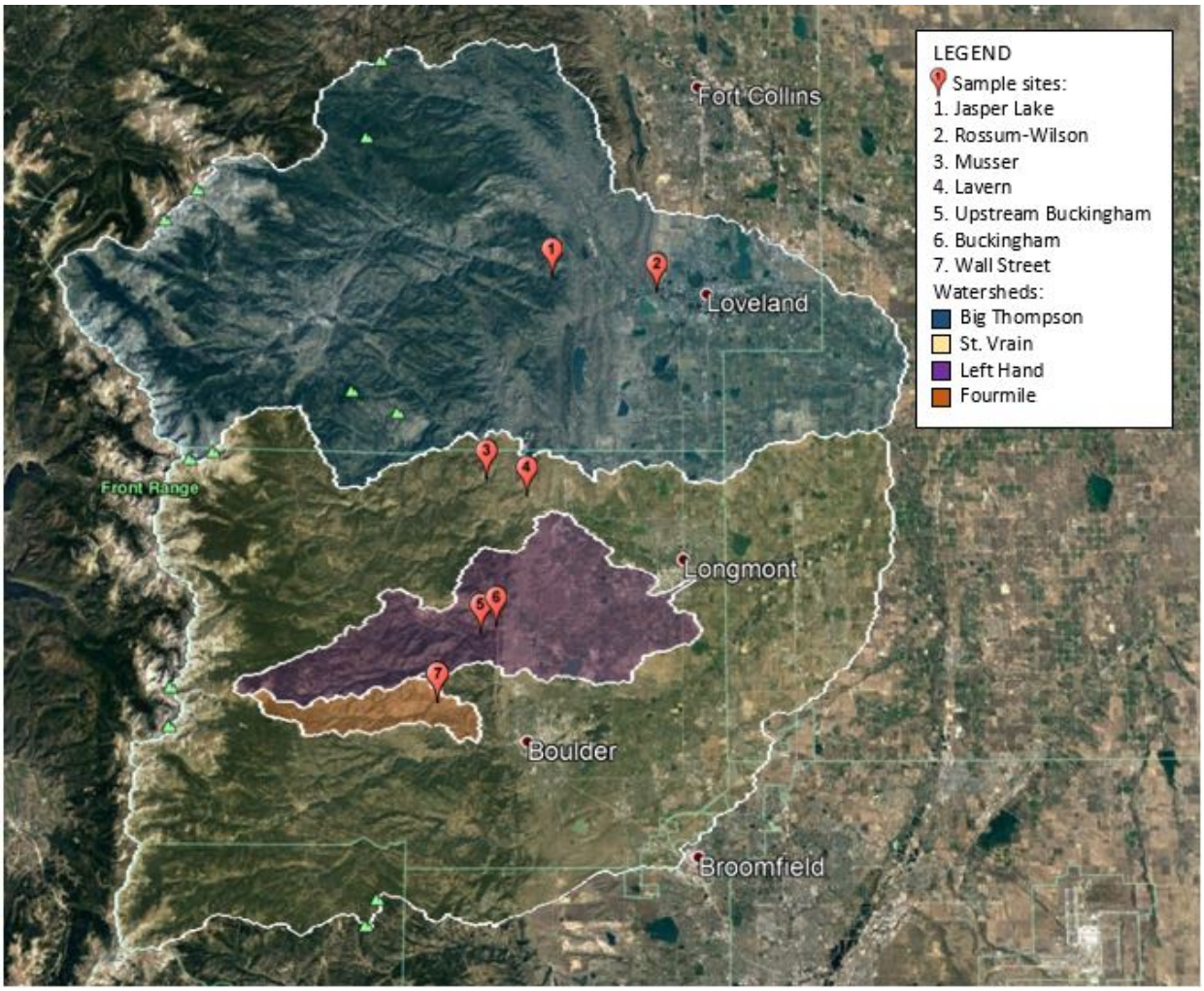

Figure 1. The watersheds (Fourmile, Left Hand, St. Vrain and Big Thompson) and sample locations surveyed in 2019 Front Range Watershed Days. Sites and names listed by number and watersheds listed by color.

The Three Watershed Health Indicators

Within each watershed, we surveyed representative creek sections, or reaches, throughout the Front Range. Resilience in the Front Range is particularly important as many communities have built homes, roads, and other infrastructure across the region. At each reach, community groups collected data about three important indicators of watershed health: Pool Habitat, Percent Sands, and Aquatic Bugs. Below are the three indicators and associated monitoring questions:

- Pool Habitat: Does our watershed provide pools large and deep enough to provide reliable fish habitat?
- Percent Sands: Does our watershed provide riffles without excess sands for reliable aquatic habitat?
- Aquatic Bugs: Does our watershed provide good enough water quality for sensitive aquatic insects?

Results and Discussion

Pool Habitat

Why do we measure it? Resilient watersheds should filter out fine sediment across the landscape and have annual flushing flows that manage sediment inputs in streams. If there are excess sediment sources or flushing flows are too low, in-stream sediment deposits, fills in pools, and reduces pool habitat. Fish require pool habitat as refuge throughout the year. And so, we monitor pool habitat to understand if our watershed has excess sediment inputs, has appropriate flushing flows, and provides adequate pool habitat for fish from year to year.

How is it measured? Pool habitat is determined based on pool area and pool depth. Pool area is the area of a sample reach that is occupied by pools. Pool depth is how much water is in the pool, excluding water flowing over top of it. We measure pool habitat by walking along a pre-defined creek length (eg. 500 feet), measuring each pool depth, and calculating the area of pools that meet specific depth requirements. For example, we do not count some pools because they are not deep enough for fish.

What do we expect to find? Naturally, the higher your stream is in elevation, the smaller, shallower, and more frequent the pools. This is because higher elevation streams are steep with steps and plunge pools. As you move farther downstream, streams are less steep with less frequent larger and deeper pools. At our sites, we generally would expect to find that pools cover 30% of the survey area and are 1.5 ft depth. In Figure 2, the orange data show what we would expect in a healthy watershed: 30% pool area (orange bar) and 1.5 ft depth (orange marker).

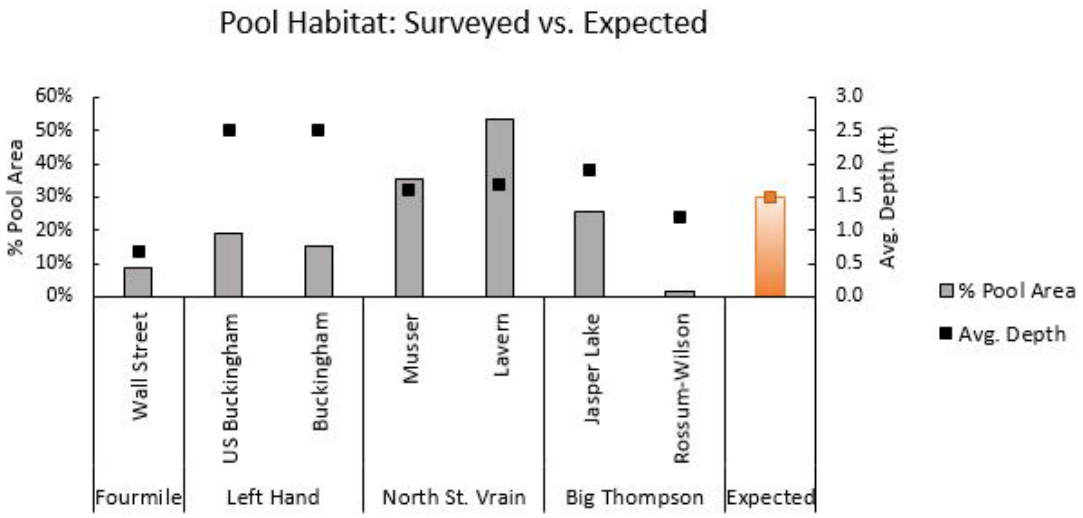

Figure 2. Pool habitat metrics, % Pool Area and Average Depth (ft), at each Front Range Watershed Days site and what we would expect in a healthy watershed (orange). Bar graph shows surveyed % pool area (left axis) and square markers show average depth (right axis).

What did we find? Overall, our results showed a lot of variability in pool habitat, including sites with very little pool area (Figure 2). Sites that had less than 30% pool area (as expected) either had an unrepresentative survey reach (the reach was not representative or long enough to capture pool habitat), or pools were too shallow for fish and were therefore not measured. Of the pools measured, sites with less than 1.5 ft average pool depth (as expected) had overall shallower pools, but pools were still deep enough for fish. While pool habitat will fluctuate from year to year, pool area less than 20% is concerning. We suspect that these sites were misrepresented in the 500 ft sample reach. Next year, we will continue monitoring pool habitat at these sites and improve our methods by increasing our reach lengths to capture an appropriate number of pools and refining our protocols.

Percent Sands

Why do we measure it? Similar to pools, resilient watersheds should filter fine sediment across the landscape and have annual flushing flows that manage sediment inputs in streams. If there are excess sediment sources or flows are too low, in-stream fine sediment will deposit and fill in riffles, specifically the crevices between larger rocks, and reduce habitat for fish and aquatic bugs. Fish and aquatic bugs rely on clean riffle substrate as habitat refuge throughout the year. And so, we monitor percent sand in riffles to understand if our watershed has excess sediment inputs, has appropriate flushing flows, and provides adequate riffle habitat for fish and aquatic bugs.

How is it measured? Percent (%) sands is the proportion of a riffle substrate (pebbles) that is sand, or a particle less than 2.0 mm in diameter. At each sample reach, we conducted pebble counts across the stream width atone to three riffles. At each riffle, we recorded the size of at least 100 random pebbles (samples). To calculate % sands, we divided the frequency of pebbles less than 2.0 mm by the total sample size. If we sampled more than one riffle, then % sands were averaged for a site.

What do we expect to find? Naturally, the higher your stream is in elevation, the lower % sands. This is because higher elevation streams are faster flowing transport reaches. As you move farther downstream, you may find greater % sands as the water slows and there is more deposition of sands. Additionally, on an annual basis, flushing flows push sediment downstream and through the watershed. At our sites, we would expect to find transport reaches with annual flushing flows that maintain less than 20% sands in riffles, as indicated by the orange line labeled “upper threshold” in Figure 3.

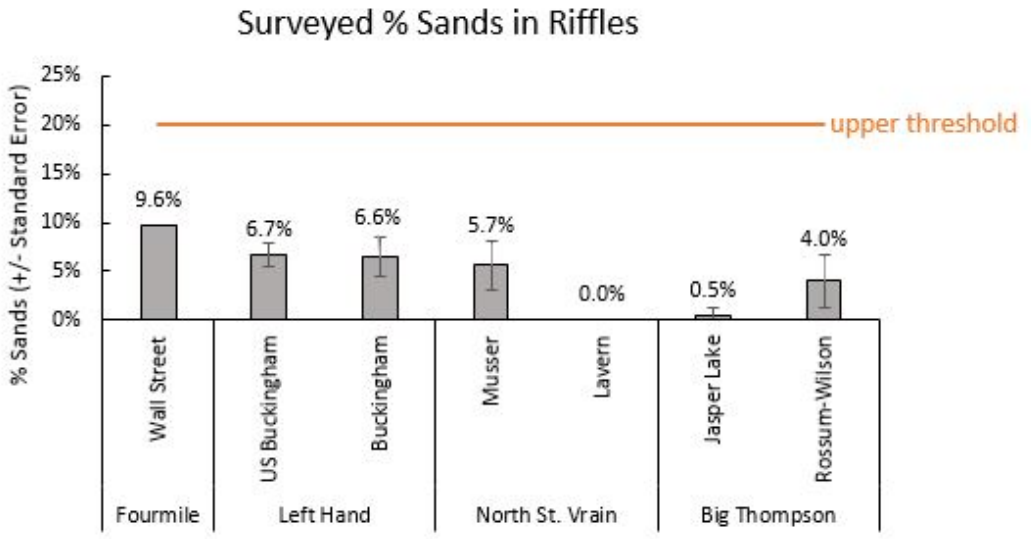

Figure 3. The average % sands (+/- standard error, if sample is greater than one) in surveyed riffles at each Front Range Watershed Days site and the upper threshold (20%) for a healthy watershed (orange line).

What did we find? We were pleased to find that % sands at all our sites were less than 20% (Figure 3). However, we were surprised to find a trend that showed sites higher in elevation (Wall Street, US Buckingham, Buckingham, and Musser) had greater % sands. While none of these sites have a sedimentation issue, we may look into why we saw this trend. It may be due to sampling error, as we would not expect to find 0% sands in these riffles, as we did at the Lavern site. Next year, we will continue monitoring % sands at these sites to assess trends over time. We also plan to improve our methods by increasing pebble counts (sample size) and refining our protocols.

Aquatic Bugs

Why do we measure it? Resilient watersheds should filter out harmful substances (eg. abandoned mine drainage, excess nutrients). If there are harmful pollutants in a stream, the aquatic bug (or Benthic Macroinvertebrate) community will be impacted. This is because aquatic bugs are confined to rocky substrate in fast moving streams and cannot move to escape water quality impairments. Therefore, the ability of aquatic bugs to survive depends on their ability to tolerate impairments. Among the aquatic bug community, there are species that are very sensitive to poor water quality. These species are referred to as EPT, an acronym for three sensitive insect orders: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). And so, we monitor percent (%) EPT insects as an indicator water quality impairments in our streams.

How is it measured? Percent (%) EPT is the proportion of aquatic bugs from a sample that are sensitive to water quality impairments. At each sample reach, we collected one aquatic bug sample from a riffle. We collected samples by kicking up riffle substrate and collecting dislodged material in a D-frame mesh net for one minute. From this sample, we randomly selected 50 to 100 insects for our sub sample. From the sub sample, we identified and recorded the frequency of all EPT individuals. To calculate % EPT, we divided the frequency of all EPT bugs by the total number of bugs in our sub sample.

What do we expect to find? Naturally, the higher your stream is in elevation, the greater % EPT. This is because higher elevation streams drain a smaller watershed area. As you move farther downstream, you may find lower % EPT as the potential for negative impacts (e.g. agricultural or urban runoff) from a larger watershed area increases. At our sites, we would expect to have greater than 50% EPT, as indicated by the orange bar labeled "lower threshold" in Figure 4.

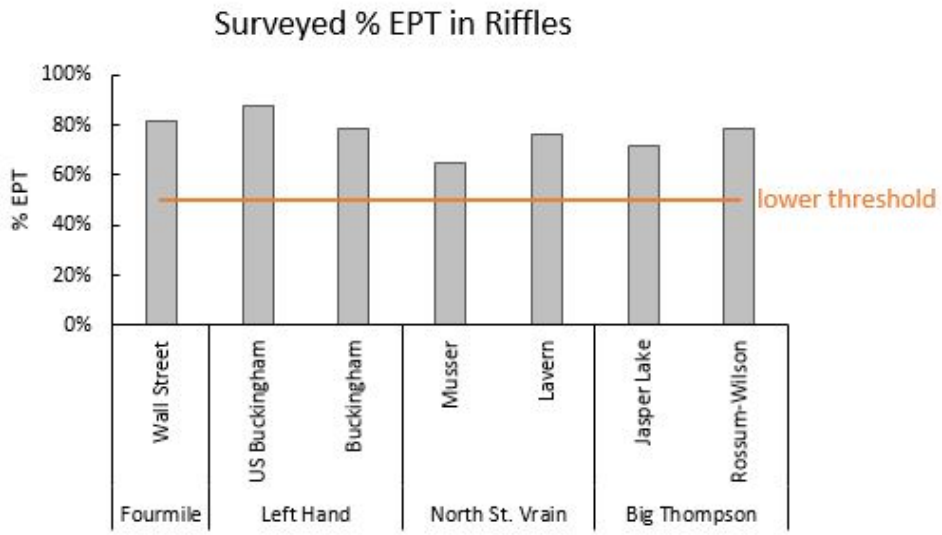

Figure 4. The % EPT in surveyed riffles at each Front Range Watershed Days site and the lower threshold (50%) for a healthy watershed (orange line).

What did we find? We were pleased to find that % EPT at all our sites exceeded 50% (Figure 4). If we consider elevation, Wall Street and US Buckingham were the two sites highest in elevation and both had the highest % EPT. Interestingly, the Rossum- Wilson site was the third highest % EPT despite having the most surrounding development and being lowest in elevation. While there are many factors that impact % EPT in our watersheds, overall, these results indicate good water quality across all sites in these watersheds. In the Future, we will continue monitoring % EPT at these sites to assess trends over time as well as compare our data to expert data to assess quality assurance of our community-based methods.

Conclusions

1. Pool Habitat: our results were highly variable and we need to standardize the measured reach length to 1000 ft to ensure we are recording representative data.
2. Percent Sands: we do not have sedimentation issues, but we need to increase our sample size and improve our training techniques for the protocol to ensure we are recording representative data.
3. Aquatic Bugs: we have good water quality and sensitive insect communities at all sites. In the future, we plan to compare our data with expert data to assess quality assurance of our community methods.