Native Waters on Arid Lands

**Riverine Recovery and Resilience.**

A Cooperative Project Between First Americans Land Grant Consortium and Navajo Technical University.
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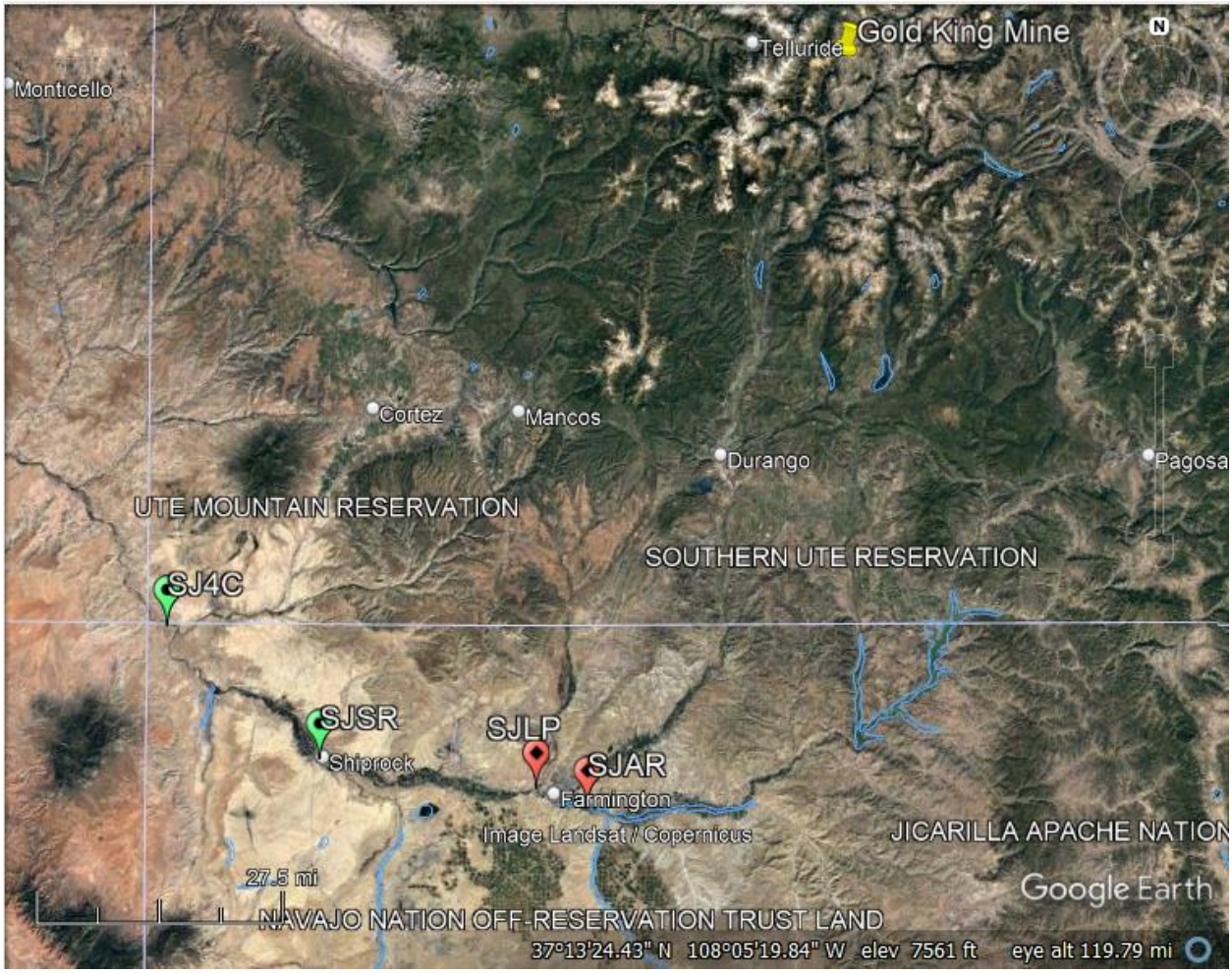
The San Juan River originates in the Colorado Rockies and flows through the 4-Corners area before terminating in Lake Powell (UT). On August 5, 2015, there was a significant spill of contaminated mine waste from the Gold King Mine (GKM) in Colorado which flowed into the Animas River, then into the San Juan River system near Farmington, NM, then through land owned by the Navajo Nation in NM, AZ and UT and into Lake Powell. (see: 2015 San Juan River Fact Sheet, Spill at the Gold King Mine. https://www.epa.gov/sites/production/files/2015-08/documents/goldkingminefactsheet15aug2015.pdf Extensive post-spill monitoring has been, and continues to be, conducted in the San Juan River by local, state, federal and tribal agencies. In 2016, benthic invertebrate surveys were conducted at San Juan River monitoring sites including several in the Navajo Nation (https://www.epa.gov/goldkingmine/follow-monitoring-data-gold-king-mine-incident).

Stream biological assessments (**Biosurveys**) are direct measures of the resident biota of a stream. Biosurveys evaluate if a water body supports its designated uses. **Biocriteria** are regulatory-based measures that provide a benchmark to describe the desired condition of a system. They serve as a standard for direct comparison of the condition of the biota that live in aquatic systems. **Biological Indices** are developed as an aggregation of individual metrics that are most informative and relevant to the ecology of the streams within an ecoregion. Under the Clean Water Act (CWA), States, and Tribes with CWA §518 authority, are required to develop biocriteria, but they are given flexibility in how that is done. There is substantial variation in how states and tribes have approached this issue (https://www.epa.gov/sites/production/files/2015-10/documents/technical-components-factsheet.pdf ) For example, Colorado uses a "multi-metric index" that is calculated differently for the different biotypes within the state while New Mexico uses a "stream condition index" whereby study sites are compared to a reference site.

This project was a desk-top evaluation of stream "health" in the San Juan River. Project consultants from FALCON worked with a Faculty member and Student Research Assistant from NTU to complete the project. More specifically, Biological Indices were calculated from benthic invertebrate Biosurvey samples collected 1 year after the GKM spill. Samples were collected in August 2016 and again in September 2016 by the USEPA; different taxonomic contractors were used for the August vs September samples. The sampling program included a "reference" site immediately upstream of the confluence of the Animas River with the San Juan River (SJAR), a near-field site in Farmington, NM (SJLP), a downstream site near Ship Rock NM (SJSR), and another near Four Corners (SJ4C); see Figure 1.

Biological Indices were calculated according to the methods used by Colorado (https://www.colorado.gov/pacific/sites/default/files/Policy%2010-1_Appendices.pdf) and New Mexico (https://documents.deq.utah.gov/water-quality/monitoring-reporting/integrated-report/DWQ-2017-004941.pdf). Biological Index results and state guidance were then interpreted to determine: a) which sites were in attainment with state Biocriteria, and b) if attainment determinations were the same with both states' methods.

*Figure 1. Mine Site and Study Sites. August 2016 results using Colorado Method: Green = Attainment; Red = Not in Attainment*




There were several differences in Biocriteria attainment when sites were compared over months (August vs September) and between the methods used by Colorado and New Mexico (Table 1). Overall, the system in summer 2016 can be classified as "healthy" based upon 64% of the samples meeting the attainment goals. This indicates resilience and recovery of the benthic invertebrate community one year after the spill. Each of the Colorado sites flipped its impairment status between months which indicates that there may be substantial differences in the taxonomic resolution between the two taxonomy contractors. It is important to note that the upstream/reference site, SJAR, was determined to be "Impaired" in August, 2016 which indicates that this system is likely subject to stressors beyond the GKM spill.

*Table 1. Biocriteria Attainment Summary: Colorado vs New Mexico*

| Site | Colorado Method | New Mexico Method |
|---|---|---|
| SJAR August 2016 | Impaired | NA* |
| SJAR September 2016 | Not Impaired | NA* |
| SJLP August 2016 | Impaired | Not Impaired |
| SJLP September 2016 | Not Impaired | Not Impaired |
| SJSR August 2016 | Not Impaired | Not Impaired |
| SJSR September 2016 | Impaired | Not Impaired |
| SJ4C August 2016 | Not Impaired | Not Impaired |
| SJ4C September 2016 | Impaired | Impaired |

*Reference Site against which the other sites were compared using the NM Method.

This desktop study exposed NTU's project team members to the following:

- Literature and Public Data on the GKM Spill
- Ways to access, download and use USEPA data
- The importance of conducting QA/QC checks on datasets
- Use of the government's ITIS Taxonomic Database
- Methods used by regulators to implement the Clean Water Act
- Messy/Conflicting Data/Results
- Ways in which an imbalanced or small data set can skew results

Some Ideas for Follow-on Research:

- Determine Biocriteria Attainment using the methods of Utah* and/or Arizona (desktop study)
- Obtain USEPA water quality data for the sampling dates on which the biosurveys were conducted and determine if there were exceedances of Aquatic Life (Water Quality) Criteria (desktop study)
- Collect new biosurvey samples and evaluate attainment in 2021 with the biological indices of Colorado and/or New Mexico. In short, evaluate if additional "recovery" can be detected (field study)

*The officials in Utah who have access to the 2016 biosurvey and RIVPACS model have been identified.

NOTE: This approach/method can also be exported to other river systems to evaluate the importance of geopolitical boundaries in classification of rivers as "impaired" or "healthy". Potential study sites in which the states have different approaches to biocriteria development include:

- Tongue River: crosses the WY-MT line near the land of both the Northern Cheyenne and Crow Tribes, served by Dull Knife and Little Big Horn Colleges, respectively.
- White River: crosses the NE-SD line in the Ogalala Lakota reservation, served by Ogalala Lakota College
- Keya Paha River: crosses the NE-SD line near the Rosebud Sioux reservation, served by Sinte Gleska University