Overview of Hydraulic Mining

The impacts of hydraulic mining practices to extract gold in the Sierra Nevada mountains that originated over 150 years ago and continued for approximately a century afterwards, continue to affect water resources in northern California today. Hydraulic mining uses high-pressure jets of water, directed through monitors, to dislodge earthen material and move sediment. The resulting slurry was directed through wooden sluices, during which elemental mercury was incorporated to the slurry to aid in gold extraction. The photo below is from Malakoff Diggins, the largest hydraulic mine created in California, and shows multiple monitors and a wooden sluice. The Yuba River watershed was the most heavily mined; the North Yuba River will be the focus of this research effort.

Timeline of Hydraulic Mining in California

- **1853**: Creation of hydraulic mining and beginning of use in Yuba River watershed to retrieve gold found in alluvial deposits.
- **1893**: Licensed Period of Hydraulic Mining.
- **Present Day**: Last license is issued by CDC. Represents the approximate end of hydraulic mining for gold in California.

Negative Impacts of Hydraulic Mining

- Production and mobilization of massive volumes of sediment. It is estimated that over 1.2 billion cubic meters of sediment and debris was removed from the Sierra Nevada following the discovery of gold during this initial burst of hydraulic mining between the years of 1853 and 1884.
- Introduction of mercury into the environment, where it still persists to this day and has found in water, sediment, and living organisms from historical mining locations along the Yuba River downstream to the San Francisco Bay where water originating in the Yuba River watershed flows out into the Pacific Ocean.
- Under certain conditions, mercury methylation can occur. Methylmercury is a very powerful neurotoxin. It is able to bioaccumulate and biomagnify, and it presents a very real danger to people and the environment.

Research Questions

1. How many hydraulic mining features are present in the study area?
2. What is their geomorphometric characterization and current condition?
3. What were overall estimated volumes of sediment produced by hydraulic mining sites in the study area?
4. What are estimated volumes of sediment still remaining within the watershed?
5. Based on results of this study, what is an appropriate methodology for categorizing and classifying hydraulic mining features in order to prioritize them for further investigation and assessment, with the end goal of environmental remediation?

Negative Impacts of Hydraulic Mining

- Evidence of hydraulic mining in upper tributaries within subwatersheds
- Approximately 0.4 million cubic meters entrapped behind DCDs (5% of total mined)*
- Approximately 10.6 million cubic meters mined*

Methodology

The Research Questions will be answered through a two-step process: (1) extensive review and analysis of a LIDAR dataset via the geoprocessing tools available in ArcGIS, and (2) field visits to numerous sites to document and characterize hydraulic mining features in person for comparison to LIDAR dataset results. Both LIDAR and ArcGIS are described in further detail to the right. For the final research question, the results of the inventory and characterization will inform prioritization.

Preliminary Results

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Evidence of Hydraulic Mining</th>
<th>Surface Area (m²)</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malakoff Diggins</td>
<td>Headwaters of Williamson Creek</td>
<td>352,024</td>
<td>657,111</td>
</tr>
<tr>
<td>Brandy Creek</td>
<td>Headwaters of Williamson Creek</td>
<td>299,354</td>
<td>2,853,841</td>
</tr>
<tr>
<td>West Fork</td>
<td>Headwaters of Williamson Creek</td>
<td>349,586</td>
<td>1,079,152</td>
</tr>
<tr>
<td>Goosen</td>
<td>Headwaters of Williamson Creek</td>
<td>463,130</td>
<td>1,079,152</td>
</tr>
<tr>
<td>Horse Valley Creek</td>
<td>Headwaters of Williamson Creek</td>
<td>382,154</td>
<td>920,952</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>Headwaters of Williamson Creek</td>
<td>382,154</td>
<td>920,952</td>
</tr>
</tbody>
</table>

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Anticipated Results for the North Yuba

- A larger number of hydraulic mining features will be identified, mapped, and characterized as part of this study than estimates of the number of features from previous studies.
- Sediment volumes (1) removed from hydraulic mining sites in the North Yuba River and (2) remaining in the watershed will be estimated and used to estimate the proportion of sediment production that moved out of the watershed.
- Using the methodology developed, the hydraulic mining features inventoried will be classified and prioritized with regard to further investigation and environmental remediation and next steps will be recommended.
- This study will serve as a pilot study that can then be replicated in other areas affected by hydraulic mining, namely the South and Middle Yuba River and the Bear River watersheds.
- The results of this study will be used by USFS to inform their management of the study area.

Notes

- References to previous studies or results shown here are cited in Thesis Proposal.
- The study is currently underway and expected to be complete by May 2018.

Project Supporters and Partners:

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