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Regional Sediment Management Program Sacramento District (SPA):

Post-Wildfire Sedimentation Impacts to Cochiti Lake Flood-Risk Management Operations

Description

The 2011 Las Conchas Wildfire burned more than 600 km^2 of forested land in the Jemez Mountains. Burn severity was greatest in the mountainous headwaters of some 15 streams that drain directly to the Rio Grande and into USACE's Cochiti Lake. The affected basins have shed sediment at rates far above their historic quantities. Significant uncertainty exists regarding the conditions under which burned portions of the watershed are likely to stabilize and upstream sediment retention facilities likely to regain utility. Recovery of these watersheds is decades away, creating an ongoing sediment management problem at Cochiti Lake. Observational and limited modeling data indicate dramatic changes in watershed hydrology have occurred within the burn area. Calibrated hydrologic studies at Santa Clara Creek found that post-fire peak flow conditions increased by 400% (e.g., 1% chance event increased from 140 to 560 m^3/s). Other tributaries where data have been collected, such as Frijoles Canyon in Bandelier National Monument, show similar ongoing changes in flood hydrology. Affected channels initially incised but now have aggraded 2 - 5 meters (m), in some reaches. The amount of future aggradation is unknown. Sediment flushing from Peralta Creek plugged the Rio Grande in Sept 2013, compromising Flood Risk Management operations at Cochiti Dam until the plug could be cleared.

Issue/Challenge To Address

A return to pre-fire hydrologic conditions is not anticipated to occur in the near future. Drought and an arid climate have combined to slow vegetation re-establishment of the burn scar. Soil fragmentation due to mass wasting processes (i.e., landslides, debris flows, soil sloughing, hyperconcentrated flows and massive gully formation) are being documented. These processes deliver sediment to the valley bottoms and are subsequently available for sediment mobilization. Both local aggradation near the mass wasting sites as well as broad aggradation throughout the downstream watershed has not yet systematically been quantified. Understanding what these conditions might be, and the volume of sediment that could be transported, are key elements of this proposal.

The objectives of this effort are to develop HEC-RAS and SIAM models that can be used to evaluate system-scale sediment processes and linkages within Cochiti Lake watershed. This modeling effort will be used to develop probability-based estimates of sediment yields for FRM operations.

Successes Lessons Learned

Lessons learned will be compiled during the duration of this study

Expected Products

- The 1D HEC-RAS and SIAM models will be provided in electronic format for future applications, any code developed, and all data in raw format.
- ERDC Technical Report summarizing the study findings, to include; describing model development, application and limitations, approach for sediment yield estimates, and recommendations for future work.
- Development of a workshop describing modeling approach, methodology, results, and conclusions; and collaborative development of a system-wide sediment management program with SPA USACE personnel and other applicable local agencies.

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Stakeholders/Users

SPA and ERDC are already in collaboration with other stakeholders. These collaborators will obviously be partners on this study, as all of our findings will be easily extrapolated to their specific watersheds of concern. Our prominent ongoing partners are Cochiti Pueblo, Santa Clara Pueblo, Bandelier National Monument, US Forest Service, Bureau of Land Management, State of New Mexico and The Nature Conservancy. These collaborators will provide reviews and use our data to expand the spatial extent of the study.

Projected Benefits

While there have been previous studies of the watershed effects of smaller Jemez Mountains fires, it is obvious that the sheer size of Las Conchas burn scar created a different landscape evolution environment. The increased sediment loading which has negatively impacted natural resources on agency lands along the Rio Grande and at the upper end of Cochiti Lake has not yet been addressed, but desperately needs to be, especially the long-term sediment impacts. Unfortunately, the Las Conchas fire is not a unique event. Results from this project will be applied to several areas affected by other Western wildfires (e.g., Waldo Canyon, Tres Lagunas, Whitewater-Baldy, and Little Bear). This work will set the stage for developing a national framework for addressing post-fire sediment movement.

Leveraging Opportunities

Because of the diversity of Federal, Tribal, and other affected entities, efforts to study the impacts and plan for recovery are fragmented:

- Santa Clara Pueblo with the greatest life-safety risk: FEMA leads a National Disaster Recovery Framework effort for long-term watershed recovery focusing on temporary and permanent flood risk management facilities and forest stabilization. The Pueblo is also participating in USACE Section 203 and 205 projects which will be joined with this project for upstream sediment management decisions.
- Cochiti Pueblo is also working with USACE CW authorities (Section 205) build permanent FRM infrastructure. The project will prepare a numerical modeling approach that will be joined with this project for downstream management decisions.
- The Bandelier National Monument team is focused on both improved public safety through reducing flood risk and natural regeneration of forest ecosystems in the Frijoles watershed. They have hired USACE through our FPMS authorities to develop post-fire hydrology and floodplains and are collecting sediment data that will be used here.
- The Jemez Mountain Team (lead by U.S. Forest Service and The Nature Conservancy, partially funded by USACE-SPA Flood Risk Management Program) is focused on implementing forest management measures to pro-actively reduce the likelihood of additional catastrophic fires in the Jemez Mountains.

This effort will leverage these studies and others to answer two outstanding questions: How long and how much sediment will be transported.

Points of Contact

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Participating Partners

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