Advancing Environmental Evaluation Capabilities for Sustainable Sediment Management

Reference SON: *2023-1957 - Evaluation Tools for Comprehensive Analysis of Sustainable Sediment Management and Ecological Impacts*

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Research Need

USACE operates approximately 740 dams across the nation. Many U.S. reservoirs have reduced storage capacity and are approaching their economic design life due to sediment trapping and accumulation[1]. Dams disrupt sediment continuity and hydrologic regimes in rivers resulting in geomorphic and ecological effects on downstream ecosystems[2,3]. Both reservoir design life and ecosystem health could benefit from restoring sediment continuity through reservoirs. However, there is a need to better understand both the potential benefits and impacts of downstream sediment release[4]. Uncertainty and lack of capability to predict environmental impacts present a barrier to practitioners for implementing management techniques that release sediment downstream.

In order to inform regulatory compliance and facilitate planning for sustainable reservoir management, tools linking geomorphic change to water quality and ecological processes are needed.

Project Purpose & Objectives

This project will expand USACE capabilities to assess ecological outcomes in response to hydrogeomorphic changes resulting from sustainable sediment management practices. The project builds on a previous effort - Ecological Effects of Reservoir Sediment Release. Several deliverables are proposed for this project:

- Synthesize a library of references, case studies and tools related to sustainable sediment management; develop and document a web-based app to collate sources and identify key aspects of sediment management decisions.
- Compile data from existing projects for validation of a model linking physical and ecological parameters.
- Conduct workshop with practitioners and researchers to gather feedback for model development and approach.
- Develop a numerical model for a specific case study linking physical and ecological parameters to assess impacts and

benefits of sediment release; use data compiled from existing projects for validation and refinement for submission to ECO-PCX for review and certification.
- Present model development through written documentation, conferences and webinars and develop training modules on developing linked physical and ecological models relevant to sediment release management alternatives.

Value of Research and Development (Payoff)

Sedimentation issues faced by USACE Districts will continue to worsen if not addressed promptly. Developing tools to assess impacts and benefits of sediment management strategies will inform USACE regulatory and feasibility studies and provide capabilities to restore reservoir benefits while providing opportunities to restore sediment regimes in sediment starved systems. This research will place USACE at the forefront of sustainable sediment management.

Products and Deliverables

Technical Notes (TNs)

Harris, A.E., G. Menichino, D.D. Hernández-Abrams, and S.E. Bailey. (in prep.). Web application user's guide for advancing ecological effect evaluation of sediment release (ERDC/TN EMRRP-??-??), Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Other Reports/Models/Tools/Datasets

Menichino, G.T. (2025). Reservoir Sustainable Sediment Tool (RESST). Web App. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. https://experience.arcgis.com/experience/b1eec438459e45c284df2fcf89e5d8e0.

Conference Presentations/Webinars/Workshops

Harris, A.E., D.D. Hernández-Abrams and G.T. Menichino. (2025). Assessing Ecological Effects of Sediment Release, EMRRP Webinar. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Communication (Social Media, Videos, Podcasts, Photos, etc.)

Tuttle Creek Lake, U.S. Army Corps of Engineers Facebook page: https://www.facebook.com/USACETuttle/ .

News Release: Innovative Water Injection Dredging pilot project set to begin Sept. 17 at Tuttle Creek Lake. Kansas City District, Published Sept. 11, 2025.

https://www.nwk.usace.army.mil/Media/News-Releases/Article/4301353/innovative-water-injection-dredging-pilot-project-set-to-begin-sept-17-at-tuttl/.

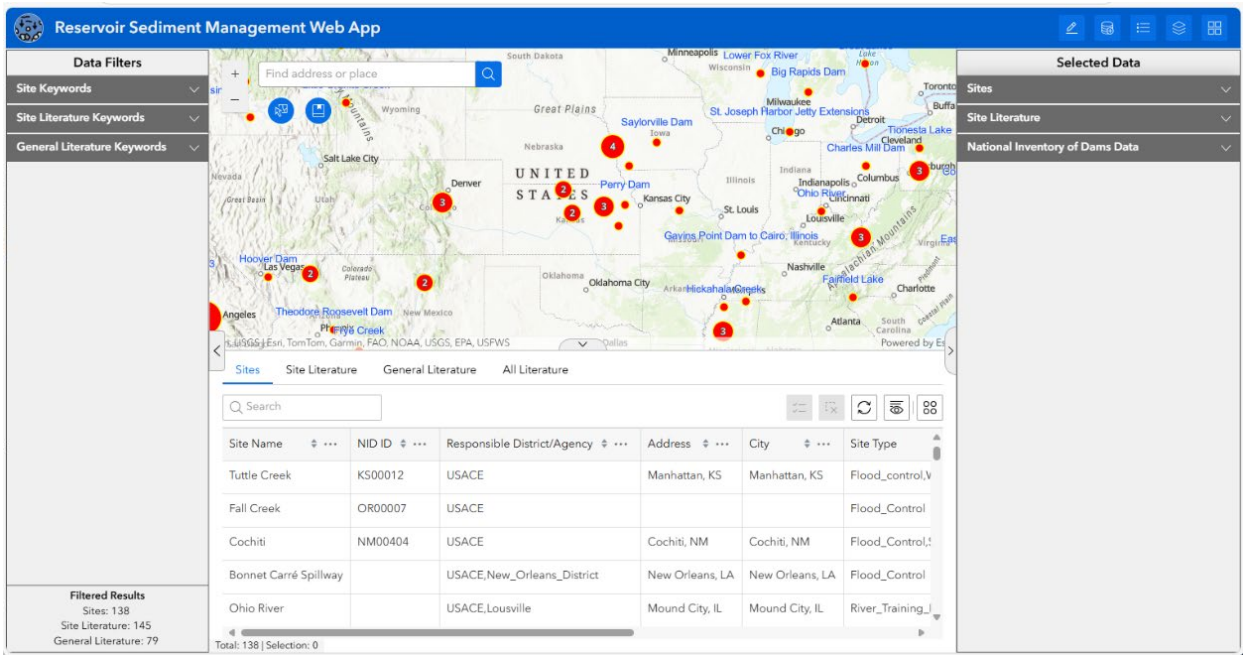
[1]Randle, T., Morris, G., Whelan, M., Baker, B., Annandale, G., Hotchkiss, R., ... and Tullos, D. (2019). Reservoir sediment management: building a legacy of sustainable water storage reservoirs. National reservoir sedimentation and sustainability team white paper, 57.

[2]Graf, W. L. (2006). "Downstream hydrologic and geomorphic effects of large dams on American rivers". Geomorphology, 79(3-4), 336-360.

[3]Kondolf, G. M., Gao, Y., Annandale, G.W., Morris, G.L., Jiang, E., Zhang, J., Cao, Y., Carling, P., Fu, K., Guo, Q., Hotchkiss, R., Peteuil, C., Sumi, T., Wang, H., Wang, Z., Wei, Z., Wu, B., Wu, C., and Yang, C.T. (2014) "Sustainable Sediment Management in Reservoirs and Regulated Rivers: Experiences from Five Continents." Earth's Future, 2:5, pp. 256-280.

[4]Juracek, K. E. (2015). "The aging of America's reservoirs: in-reservoir and downstream physical changes and habitat implications". JAWRA Journal of the American Water Resources Association, 51(1), 168-184.

IMAGES



Picture 1. Screen shot of Reservoir Sediment Management Web App

Picture 2. Tuttle Creek water injection dredge (WID) demonstration. (Top) Fully assembled WID in Tuttle Creek Reservoir (Photo credit Laura Totten). (Bottom) Water jetting from WID spray bar (Photo credit Laura Totten).

Picture 3. Fish diet sampling during Water Injection Dredging (WID) downstream of Tuttle Creek Reservoir at the confluence of the Big Blue and Kansas rivers (left, center; Logan Rowley with KSU and Cooper Hernandez), and water-quality sampling on the Big Blue River during WID operations (right; Marvin Boyer with NWK and Ariana Martinez and Cassidy Schmidt with KSU).