

RESULTS OF THE AWARD

Summary

- Published a research article titled “Estimating rates and properties of sediment accumulation behind a dam: Englebright Lake, Yuba River, northern California” in *Water Resources Research*.
- Published four U.S. Geological Survey reports on reservoir sedimentation in the Yuba River system.
- Presented scientific results at seminars and meetings including the CALFED Science Conference, Geological Society of America, and the American Geophysical Union.
- Oversaw analysis of 561 subsamples from Englebright Lake cores and grab samples for grain-size distribution, organic content, and geochronology.
- Estimated that Englebright Lake is 25.5% full with 26×10^6 metric tons of sediment, which is about 2/3 sand and gravel.
- Calculated that the Yuba River sediment yield is approximately 340 metric tons/km²/yr.
- Produced one of the most thorough portraits of sedimentation behind a dam ever collected.

Narrative

The most significant result of the project has been a thorough quantification of the history, physical properties and accumulation rates of sediment behind a large dam. As a result of this project and my collaboration with other U.S. Geological Survey (USGS) researchers, Englebright Lake is one of the best-characterized reservoir deposits in the western United States. The mass of the reservoir deposit is estimated to be $\sim 26 \times 10^6$ metric tons (t) of material, of which 64.8 to 68.5 percent is sand and gravel. Over the 61-year reservoir history the maximum basin-wide sediment yield is ~ 340 t/km²/yr, which is a rapid transport rate, but within the range of other northern California reservoirs. Analysis of the reservoir stratigraphy and watershed hydrology indicates that sediment-transport rates may be declining due to changes in upstream dam management and winnowing of 19th-century Gold Rush mining debris. This well-characterized reservoir delta is already being applied to other reservoirs that lack such detailed studies.

The scientific results of my CALFED Science Fellows award are detailed in a series of publications. The most significant results of the project are detailed in an article called “Estimating rates and properties of sediment accumulation behind a dam: Englebright Lake, Yuba River, northern California” which was published in the November 2004 issue of the journal *Water Resources Research*. I have included a PDF version of this article with this postaward report. In addition, four other reports have been published online by the USGS. Web addresses for these reports are included in the publications list below. At present, I am continuing work with my USGS collaborators on another article, which will be submitted to a journal this year. The working title of this manuscript is “Reconstructing depositional history and processes from reservoir stratigraphy: Englebright Lake, Yuba River, northern California.” This work was presented in

preliminary form at the American Geophysical Union meeting in San Francisco in December 2004. These articles and reports represent the completion of tasks 1 (Correlate the stratigraphic record with the discharge record) and 2 (Calculate sediment volumes and grain sizes for each event) from the original proposal. My postdoctoral research on the project lasted only two years instead of the three originally planned because I started a faculty position at Boston College in 2004. Therefore, tasks 3 (Extend the sediment rating curve to higher discharges using flood deposits) and 4 (Investigate the roles of flow and supply limitation on sediment transport rates) will not be completed as part of the fellowship. However, I anticipate that work on these tasks will continue with my collaborators over the next year or two. This will result in completion of the projected accomplishments and core goals of the project, with significant contributions to all of the objectives from my original proposal.

A central goal of this project was to add to the scientific and decision-making value of the Upper Yuba River Studies Program (UYRSP), which is funded by the CALFED Ecosystem Restoration program. I collaborate directly with Charles Alpers and Lorraine Flint (principal investigators of the UYRSP, from the USGS in Sacramento) on the sediment and water-quality studies of the program. The UYRSP funded the sampling campaigns in Englebright Lake used for this study, and many of the laboratory analyses. I have also worked with other members of the UYRSP Agency Team: participating in meetings; sharing figures, data, and interpretations. I gave a presentation at the UYRSP Technical Review Panel public meeting in Nevada City in October 2002. I also presented results at the CALFED Science Conferences in Sacramento in 2003 and 2004, and at national meetings of the Geological Society of America and the American Geophysical Union.

PUBLICATIONS LIST

Articles and reports

- Snyder, N.P., Rubin, D.M., Alpers, C.N., Childs, J.R., Curtis, J.A., Flint, L.E., and Wright, S.A., 2004, Estimating rates and properties of sediment accumulation behind a dam: Englebright Lake, Yuba River, northern California, *Water Resources Research*, v. 40, W11301, doi:10.1029/2004WR003279.
- Snyder, N.P., Allen, J.R., Dare, C., Hampton, M.A., Schneider, G., Wooley, R.J., Alpers, C.N., and Marvin-DiPasquale M.C., 2004, Sediment grain-size and loss-on-ignition analyses from 2002 Englebright Lake coring and sampling campaigns, U.S. Geological Survey Open-File Report 2004-1080, <http://pubs.usgs.gov/of/2004/1080/>, 46 p.
- Snyder, N.P., Alpers, C.N., Flint, L.E., Curtis, J.A., Hampton, M.A., Haskell, B.J., and Nielson, D.L., 2004, Report on the May-June 2002 Englebright Lake deep coring campaign, U.S. Geological Survey Open-File Report 2004-1061, <http://pubs.usgs.gov/of/2004/1061/>, 32 p., 10 plates.
- Snyder, N.P., and Hampton, M.A., 2003, Preliminary cross section of Englebright Lake sediments, U.S. Geological Survey Open-File Report 03-397, <http://geopubs.wr.usgs.gov/open-file/of03-397/>, 1 plate.

Childs, J.R., Snyder, N.P., Hampton, M.A., 2003, Bathymetric and geophysical surveys of Englebright Lake, Yuba-Nevada Counties, California: U.S. Geological Survey Open-File Report 03-383, <http://geopubs.wr.usgs.gov/open-file/of03-383/>, 20 p.

Presentations and abstracts

- Snyder, N.P., Alpers, C.N., Childs, J.R., Curtis, J.A., Flint, L.E., Holmes, C.W., Rubin, D.M., and Wright, S.A., 2004, Reconstructing watershed history from reservoir stratigraphy: Englebright Lake, northern California, *Eos, Transactions, AGU*, American Geophysical Union, San Francisco, CA, December 15-19, 2004.
- Snyder, N.P., Alpers, C.N., Childs, J.R., Curtis, J.A., Flint, L.E., Holmes, C.W., Rubin, D.M., and Wright, S.A., 2004, Rates and history of sediment accumulation behind Englebright Dam, CALFED Science Conference, Sacramento, CA, October 4-6, 2004.
- Alpers, C.N., Hunerlach, M.P., Marvin-DiPasquale, M.C., Snyder, N.P., and Krabbenhoft, D.P., 2004, Mercury and methylmercury in the upper Yuba River watershed: fluvial transport and reservoir sedimentation, CALFED Science Conference, Sacramento, CA, October 4-6, 2004.
- Snyder, N.P., Childs, J.R., Hampton, M.A., Rubin, D.M., Alpers, C.N., Flint, L.E., Curtis, J.A., Wright, S.A., and Topping, D.J., 2003, The history and future of sediment deposition behind Englebright Dam, Yuba River, northern California, *Annual Meeting Expanded Abstracts*, Geological Society of America, Seattle, WA, November 2-5, 2003.
- Snyder, N.P., 2003, UYRSP sediment studies: sediment deposited in Englebright Lake: Upper Yuba River Studies Program Technical Review Panel meeting, Nevada City, CA, September 30-October 2, 2003.
- Snyder, N.P., Rubin, D.M., Alpers, C.N., Flint, L.E., Curtis, J.A., Childs, J.R., and Haskell, B.J., 2003, Preliminary results from the 2002 Englebright Lake coring project: a record of rapid sedimentation in the Yuba River system, CALFED Science Conference, Sacramento, CA, January 14-16, 2003.

Also presented aspects of this research in department seminar series including: Boston College (Nov. 2004 and Feb. 2003); USGS, Menlo Park and Santa Cruz (Apr. 2004); University of Montana (Mar. 2003); Rice University (Mar. 2003); San Francisco State University (Feb. 2003); Oregon State University (Feb. 2003); and University of California, Santa Cruz (January 2003).