Mark S. Lorang
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Bigfork Montana, 59911
406 420 2295
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EDUCATION:

B.A.	**Geology**	The University of Montana	1983
M.S.	**Oceanography**	Oregon State University (P.D. Komar, Advisor)	1992

Thesis Title "Lake Level Regulation, Shoreline Erosion and Shore Protection: Flathead Lake, Montana"

Ph.D.	**Oceanography**	Oregon State University (P.C. Klingeman, Advisor)	1997

Dissertation Title "Wave Competence and Morphodynamics of Boulder and Gravel Beaches"

PROFESSIONAL EXPERIENCE:

Research Associate Professor, Flathead Lake Biological Station, (2009 –April 2016)

Research Assistant Professor, Flathead Lake Biological Station, The University of Montana (2002-2009)

Research Associate, Flathead Lake Biological Station, The University of Montana (2000-2002)

Visiting Assistant Professor, Geography Department, University of Oregon (1998-2000)

Post Doctoral Fellow, Geography Department, University of Southern California (1997-1998)

AWARDS AND HONORS

POST DOCTORAL FELLOWSHIP (1997-98) – University of Southern California
DEAN FELLOWSHIP (1994-95) - College of Oceanography and Atmospheric Science, Oregon State University.
COBLER AWARD (1993) - College of Oceanography and Atmospheric Science, Oregon State University, Annual award for outstanding research by a graduate student
UNIVERSITIES COUNCIL ON WATER RESOURCES DISSERTATION/THESIS AWARD, Honorable Mention (1993) –A national award for an outstanding MS thesis.

COURSES TAUGHT:

Graduate:

- Geog 522 Coastal Processes
- Geog 525 Hydrology and Water Resources
- Geog 570 US West Coast Environmental Problems
- Geog. 571 Fundamentals of Sediment Transport
- Geog. 573 Fluvial Geomorphology

Undergraduate:

- Geog 101 The Natural Environment
- Oc. 331 Introduction to Oceanography
- Oc. 333 Coastal Oceanography
- Bio 495. Landscape Ecology

COMMITTEE MEMBER / CO- ADVISOR: (successfully completed theses and dissertations)

Kelly Clark, M.S., 2003. *Fluvial geomorphic response related to floodplain gravel mining : Yakima River, Washington*. Geography Department, Central Washington University. (**Co-Advisor**)

Chris Hawkins M.S., 2003. *Imaging the shallow subsurface using ground penetrating radar at the Nyack Floodplain, Montana*. Geosciences, University of Montana.

Samantha Chilcote Ph.D., 2004. *The ecology of parafluvial ponds on a Rocky Mountain flood plain*. Division of Biological Sciences, University of Montana.

Nathan Harrison, M.S. 2004. *Gravity, radar and seismic investigation to help determine geologic, hydrologic and biological relation in the Nyack Valley, Northwestern Montana.* Geosciences, University of Montana.

Brian Reid, Ph.D., 2007. *Energy flow in floodplain aquifer ecosystem,* Division of Biological Sciences, University of Montana.

Michelle Anderson, Ph.D., 2008. *The edge effect: lateral habitat ecology of an alluvial flood plain river*. Division of Biological Sciences, University of Montana.

Michael Morris, Ph.D., 2008. *The contribution of spawning Pacific salmon to nitrogen fertility and vegetation fertility during riparian primary succession on an expansive flood plain on a Large Kamchatka river*. Division of Biological Sciences, University of Montana.

Marylesa Wilde, MS, Mathematics Department, April 29, 2009, *Statistically Based Methods for Supervised Classification of Remote Sensing Data*. (**Co-Advisor** with Dr. Bardsley)

Diego Tonolla, Ph.D., 2011. *Acoustic and thermal characterization of river landscapes.* Freie Universität Berlin, Institute of Biology, Berlin, Germany. graduated **summa cum laude** (**Co-advisor** with Professor Klement Tockner). Award for the **best PhD Dissertation in Freshwater Sciences** of the European Federation for Freshwater Sciences (EFFS).

PUBLICATIONS:

Lorang, M.S. Gotschalk C, Lippmann, T.C. and G Kirilin. (In Prep). Modeling wind waves on an intermountain freshwater lake.

Kirilin,G, Lorang, M.S. Gotschalk C and Lippmann, T.C. and S. Schimmelpfennig. 2015. Surface seiches in Flathead Lake, Montana. Hydrol. Earth Syst. Sci. Discuss., 18, 1–30, 2014. doi:10.5194/hessd-18-1-2014.

Wood, M., Fosness, R., Pachman, G., Lorang, M., and Tonolla, D., 2015, Evaluation of multiple-frequency, active and passive acoustics as surrogates for bedload transport: In Proceedings of the 10th Federal Interagency Sedimentation Conference (SEDHYD), April 2015, 11 p., http://acwi.gov/sos/pubs/3rdJFIC/index.html.

Lorang, M.S. and D Tonolla 2014. Combining active and passive hydroacoustic techniques during flood events for rapid spatial mapping of bedload transport patterns in gravel-bed rivers. Special Issue: *Frontiers in real time ecohydrology*. Fundam. Appl. Limnol. Vol. 184/3 (2014), 231–246.

Malison, R. L., Lorang, M. S., Whited, D. C. and Stanford, J. A. 2014, Beavers (*Castor canadensis*) influence habitat for juvenile salmon in a large Alaskan river floodplain. Freshwater Biology, 59: 1229–1246. doi: 10.1111/fwb.12343

Lorang, M.S., Hauer, F.R., Whited, D.C., and Matson, P.L., 2013. Using airborne remote-sensing imagery to assess flow releases from a dam in order to maximize re-naturalization of a regulated gravel-bed river, *in* De Graff, J.V., and Evans, J.E., eds., *The Challenges of Dam Removal and*

River Restoration: Geological Society of America Reviews in Engineering Geology, v. XXI, p. 117–132, doi:10.1130/2013.4021(10).

Whited, D. C., J. S. Kimball, M. S. Lorang and J. A. Stanford. 2013. Estimation of juvenile salmon habitat in Pacific Rim rivers using multiscalar remote sensing and geospatial analysis. River Research and Applications 29(2):135-148.

Kirilin,G, Lorang, M.S. Gotschalk C and Lippmann, T.C. 2013. Surface seiches in Flathead Lake, Montana. Geophysical Research Abstracts Vol. 15, EGU2013-8585.

Tonolla, D., M. S. Lorang, K. Heutschi, C.C. Gotschalk and K. Tockner. 2012. Characterization of spatial heterogeneity in underwater soundscapes at the river segment scale. *Limnol. Oceanogr.*, 56(6), 2011, 2319–2333

Lorang, M.S., 2010. A wave-competence approach to distinguish between boulder and megaclast deposits due to storm waves versus tsunamis, Mar. Geol., doi:10.1016/j.margeo.2010.10.005

Tonolla, D., V. Acuña, M. S. Lorang, K. Heutschi and K. Tockner. 2010. Underwater soundscapes of typical river habitat types. *Hydrol. Process.* doi: 10.1002/hyp.7730

Tockner, K., M.S. Lorang and J.A. Stanford. 2010. River flood plains are model ecosystems to test general hydrogeomorphic and ecological concepts. *River Res Applic*. 26" 76-86.

Tockner K., M. Push, D.Borchardt, M.S. Lorang. 2010. Multiple stressors in coupled river-floodplain ecosystems *Freshwater Biology*, 55 (Suppl. 1), 135–151.

Luck, M., N. Maumenee, D. Whited, J. Lucotch, S. Chilcote, M. Lorang, D. Goodman, K. McDonald, J. Kimball and J. Stanford. 2010. Remote sensing analysis of physical complexity of North Pacific Rim Rivers to assist wild salmon conservation. *Earth Surface Processes and Landforms* 35(11):1330–1343.

Tonolla, D., M. S. Lorang, K. Heutsch and K. Tockner. 2009 A flume experiment to examine underwater sound generation by flowing water. *Aquat. Sci*. 71:449–462

Whited, D. C., M. S. Lorang, M. J. Harner, J. A. Stanford, F. R. Hauer and J. S. Kimball. 2007 Climate, hydrologic disturbance, and succession: Drivers of floodplain pattern. *Ecology* **,** 88(4), pp. 940–953.

Hauer, F. Richard, Jack. A. Stanford, and Mark S. Lorang, 2007. Pattern and Process in Northern Rocky Mountain Headwaters: Ecological Linkages in the Headwaters of the Crown of the Continent. *Journal of the American Water Resources Association* (JAWRA) 43(1):104-117.

Hauer, R.F, J.A. Stanford, M.S. Lorang, B.K. Ellis and J.A. Craft, 2007. "Aquatic Ecosystem Health*"* In: *Sustaning Rocky Mountain Landscapes: Science, Policy and Management of the Crown of the Continent Ecosystem*" A. Prato and D. Fagre (Eds) RFF Press Washington D.C., pp. 117-134.

Lorang M.S. and F.R. Hauer, 2006. "Fluvial Geomorphic Processes" In: *Methods in Stream Ecology 2nd edition*, F.R. Hauer and G.A. Lameriti (Eds.), Academic Press, San Diego, CA.

Morrison A. T. III, A. J Williams and M.S. Lorang, 2005. "Waves and Seiches in Flathead Lake, Montana: Measurements of a quite Lake by differential travel-time current measurements", *Proceedings of OCEANS 2005*.

Lorang, M.S. and G. Aggett 2005. Potential sedimentation impacts related to dam removal: Icicle Creek, Washington, U.S.A. *Geomorphology* 71:182-201.

Stanford, J.S., M.S. Lorang and F.R. Hauer. 2005. The shifting habitat mosaic of river ecosystems. *Verh. Internat. Verein. Limnol*. **29.**

Lorang, M. S, D. C. Whited, F. R. Hauer, J. S. Kimball, and J. A. Stanford. 2005. Using airborne multispectral imagery to evaluate geomorphic work across flood plains of gravel-bed rivers. *Ecological Applications,* 15(4), pp. 1209–1222.

Hauer, F. R., and M.S. Lorang. 2004. River regulation, decline of ecological resources, and potential for restoration in an arid lands river in the western USA. *Aquat. Sci. (66): 1-14.*

Lorang, M.S. and F. R. Hauer. 2003. Flow competence evaluation of streambed stability: an assessment of the technique and limitations of application. *Journal of North American Benthological Society* 22(4) 475-491.

Lorang, M.S. 2002. Predicting the crest height of a gravel beach. *Geomophology* 48: 87-101.

Bauer, B.O., M.S. Lorang and D. J. Sherman. 2002. Estimating boat-wake-induced levee erosion using sediment suspension measurements. *Jour. of Waterways, Port, Coast and Ocean Engineering* Vol. 128, No. 4: 152-162.

Lorang, M. S. 2000. Predicting threshold mass and stable boulder mass for a beach. *Journal of Coastal Research* 16(2):432-445.

Wilson, J. P. and M. S. Lorang. 1999. Spatial models of soil erosion and GIS, pp. 83-103. IN: A. S. Fotheringham and M. Wegener (eds.), *Spatial Models and GIS - New Potential and New Models*. Chichester, Taylor and Francis.

Lorang, M. S., S. Namikas, J. P. McDermott and D. J.Sherman. 1999. El Niño storm waves and the morphodynamic response of two cobble/boulder beaches. *Proc. Coastal Sediments* 99:922-937.

Lorang, M.S. and J.A. Stanford, 1993. The variability of shoreline erosion and accretion within a beach compartment on Flathead Lake, Montana. *Limnol. Oceanogr.* 38(8): 1797-1809.

Lorang, M.S., P.D. Komar and J.A. Stanford, 1993. Lake level regulation and shoreline erosion on Flathead Lake, Montana: A response to the redistribution of annual wave energy: *Journ. Coastal Research* 9(2): 494-508.

Lorang, M.S., J.A. Stanford, F.R. Hauer and J.H. Jourdonnais, 1993. Dissipative and reflective beaches in a large lake and the physical effects of lake level regulation. *Ocean & Coastal Management*, **19**: 263-287.

Lorang, M.S., 1991. An artificial perched-gravel beach as a shore protection structure. *Proc. Coastal Sediments '91*, American Society of Civil Engineers, II: 1916-1925.

Lorang, M.S. and P.D. Komar, 1991. Pebble Shape. *Nature,* 347: 433-434.

Lorang, M.S., 1985. Copper levels in the fine sediment from the middle Clark Fork River Basin, Montana: A reconnaissance field study. *Proc. Mont. Acad. Sci*., 45: 64-72.

Lorang, M.S., 1984. The use of sediment analysis, sedimentary structures and water wave measurements to quantify wave energy in a shallow fresh water bay, Flathead Lake, Montana. *Northwest Geology*, 13: 5-14.

NATIONAL AND INTERNATIONAL SYMPOSIA (Invited Talks as first Author presenter)

Using Remote Sensing Data to Assess Potential Juvenile Salmon Habitat in Pacific Rim Rivers. Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin Germany. June 13 2011.

River Analyzer: PRESIDENT'S ADVISORY COUNCIL MEETING University Center, 3rd Floor Missoula, Montana Tuesday, 3 May 2011. Invited talk by President Engstrom

The Fundamental Hydro-Geomorphic Complex of Alluvial Rivers. Limnological Research Center Kastanienbaum, Switzerland 2007, Sponsored by the Swiss Federal Institute for Environmental Science and Technology.

The Shifting Habitat Mosaic: Fluvial Geomorphic Processes and Ground-Surface Water Interaction. Vancouver, WA 2007. Sponsored by the Washington Department of Ecology.

Assessing Regulated Floods for River Restoration. Vancouver, WA. 2007. Sponsored by the Washington Department of Ecology,

River Typology and Salmon Habitat. Anchorage, AK, 2006. Workshop on Predicting Salmon Habitat in Alaska,

The Shifting Habitat Mosaic: Fluvial Geomorphic Processes and Ground-Surface Water Interaction. Bellingham, Washington. 2006. Sponsored by National Organization of Floodplain Managers NORFMA,

Using Airborne Hyperspectral Imagery, Detailed Surface Water Budgets and Radon Screening of Upwelling Surface Water to Guide Large Scale River Restoration Projects. Limnological Research Center Kastanienbaum, Switzerland 2005. Sponsored by the Swiss Federal Institute for Environmental Science and Technology.

Applying Hyperspectral Imagery to Assess the Ecological Integrity of Alluvial Flood Plains. Limnological Research Center Kastanienbaum, Switzerland 2003. Sponsored by the Swiss Federal Institute for Environmental Science and Technology.

Linking Fluvial Geomorphology to River Ecology and the Restoration of Floodplain Habitat. Longview, Washington 2003.**,** Sponsored by National Organization of Floodplain Managers NORFMA,

Linking Hyperspectral Imagery and River-Surveyor Data to Model Water Depth and Flow Velocity. Las Vegas 2003 Sontek Users Conference.

Assessing Environmental Outcomes of Community Based Collaboratives. Snowbird, Utah. 2003. Workshop organized by the Meridian Institute.

Linking Fluvial Geomorphology to River Ecology and the Restoration of Flood Plain Habitat. Vienna, Austria 2002. Sponsored by University of Vienna Biology Department.

Impacts Related to Dam Removal: Icicle Creek Washington, USA. Bloomsberg, Pennsylvania 2002.**,**The 33th Binghamton Symposium in Geomorphology,

Professional Presentations at Meetings; Performances

*(*with grad students; **with undergrad students)*

Lorang, M.S. *Wave Competence and Perceived Risk: Integrating Physical and Social Science on a Gravel Beach*. Invited International talk, Cornwall Campus Geography Seminar Series, UK. 2013.

Whited, D.C. J.S. Kimball, T. Bansak, D. DeWire, M.S. Lorang, B.K. Ellis and J. A. Stanford. "Multiscale classification of riverine floodplain physical habitats for estimating potential salmon production." Oral presentation. Fall Meeting, AGU, 13-17 December 2010, San Fransico, CA.

Stanford, J. A., G.C. Poole, A.M. Helton, M.S. Lorang, D.C. Whited, F.R. Hauer and B.K. Ellis. "integrating empirical, remote sensing and simulations science to investigate dynamic ecosystem processes of large, mult-channel floodplain rivers." Oral Presentation. North American Benthological Society (NABS) Annual Meeting 22-26 May 2011 Providence, RA.

Valett, H. M.; Lorang, M. S.; Anderson, M. S.; Bansak, T. S.; Stanford, J. A.; Location, linkage, and disturbance on a floodplain landscape: spatial influence on ecosystem function (Abstract ID: 9398) 59th National meeting of the North American Benthological Society, 22-26 May, 2001, Providence, RI.

Whited, D. C., J. S. Kimball, T. S. Bansak, M. S. Lorang, B. K. Ellis and J. A. Stanford. "*Scaling of salmon habitat types obtained by satellite remote sensing of Pacific rim rivers.*" Oral Presentation, North American Benthological Society (NABS) 58th Annual Meeting, 6–11 June 2010, Santa Fe, NM.

Lorang M.S., D. Tonolla*, K. Tockner 2009. *The Sound of Rivers*. International Society for River Science (ISRS) Promoting River Research , Conservation and Management held July 12-17, 2009 in St. Petersburg Florida

Marsh** W.M, M.S. Lorang, T. Gonser. 2006 *Preferential Flow Paths and Residence Time of Hyporheic Groundwater in an Alluvial Floodplain Middle Fork of the Flathead River, Northwest Montana.* Poster presented at the 2006 CRSSR conference in Missoula.

Tockner K., Gonser T., Uehlinger U., Lorang M., Hauer F.R., Stanford J.A. 2006 *Habitat Diversity and the shifting habitat mosaic in floodplain rivers.* Talk presented at the Gravel Bed Rivers-6 conference, UK

Lorang, M.S. F.R. Hauer, D.C. Whited and J.A. Stanford. 2005 *Hydraulic Conditions of Common Aquatic Stream Habitats*. Talk presented at American Society of Limnology and Oceanography Salt Lake City Utah.

Gonser, T, M.S. Lorang, E. Hoehn. 2005 *Linking surface/groundwater exchange patterns with fluvial geomorphic features using Rn-222.* Talk presented at American Society of Limnology and Oceanography Salt Lake City Utah.

Lorang M.S. 2005 *The Shifting Habitat Mosaic of the Nyack Flood Plain.* The Waterton-Glacier Science and History Conference Presented at the Lake McDonald Lodge Auditorium.

Lorang, M.S., F.R. Hauer and J.A. Stanford. 2004 Linking Aquatic Habitat with Fluvial Geomorphology. Talk presented at North American Benthological Society, Vancouver British Columbia

Scott* E. L. and M.S. Lorang 2004 The use of photo-sieving to identify textural facies. Talk presented at North American Benthological Society, Vancover British Columbia

Scott* E.L. and M.S**.** Lorang 2004. Variance in Photo-sieve results due to bed packing and sorting. Talk presented the American Association of Geographers, Philadelphia Pennsylvania

GRANTS AWARDED:

A). As Sole Principal Investigator/Project Director ($1,668,571)

Flathead Lake Shoreline Studies, Lorang, Confederated Salish & Kootenai Tribes, Contract #12-127 (UM index M69445), 4/1/12-9/30-12, $10,000**.**

Impacts of Dam Operation on Flow and Bedload Transport in the Shuswap River, BC, Lorang, SEC Shearing Environmental Consultants, Contract #001 (UM index M69462), 6/1/12-7/31/12, $7,297.

Flathead Lake Shoreline Studies, Lorang, Confederated Salish & Kootenai Tribes, Contract #12-127 (UM index M69445), 4/1/12-9/30-12, $15,000**.**

Sound of Rivers, Lorang, Montana State University, NSF EPSCoR Contract #G142-12-W3726 (UM index M67618), 8/1/11-8/31/12**,** $24,850.

North Shore Erosion Control. Lorang, PPL Montana, 481635, 1-1-10 to 12-31-14, $640,167.

Flathead Lake Shoreline Processes Project, Lorang, Confederated Salish and Kootenai Tribes, CSKT #10-136, 4-1-10 to 8-21-10, $20,000.

ADP Bathymetric Mapping of Lower Flathead, FCD 2010-002, 8-5-2010 to 12-31-2010. $29,019.

ADP Geomorphic Modeling Projects, Wild Fish Conservancy, M69207, 9-15-2009 to 6-30-2010, $48,810.

North Shore Flathead Erosion Beach Project, Lorang, PPL Montana, Contract #381056, 1/1/08-12/31/08, $299,507

Flathead Lake Shoreline Processes, Lorang, Confederated Salish and Kootenai Tribes, Contract #07-239, 5/15/07-9/30/08, $20,000.

North Shore Flathead Erosion Beach Project, Lorang, PPL Montana, Contract #381056, 1/1/07-12/31/07, $319,200

Flathead lake Shoreline Erosion, Lorang, (Private Lake Shore Owners), UM index number M29718, 2/6/06-12/31/07, $12,500

Flathead lake Shoreline Erosion Project, Lorang, PPL Montana, Contract # 340210-C, 2/6/06-12/31/07, $10,000.

Measuring Levee Erosion Rates in the Sacramento and San Joaquin River Delta, Lorang, California Department of Boating and Waterways as subcontract to University of British Columbia Okanagan Contract: UBC#62R03115, 1/1/07-12/31/08, $38,661

Sacramento San Joaquin Delta Studies – Field Program to Measure Levee Erosion. Lorang California Department of Boating and Waterways as subcontract to University of British Columbia Okanagan Contract: (3/04- 12-05), $9,175

Assessing Lake Wide Shoreline Erosion Lorang (10/04-9/05) Meites, Mulder, Burger and Mollica, UM# M29341, $13,300

Assessing Lake Wide Shoreline Erosion: Lorang (9/03-10/04) Meites, Mulder Burger and Mollica, UM# M29341, $12,535

Grant Creek Environmental Restoration and Flood Control Project. Lorang HDR Engineering Inc. # M29540, 2004, $4,500

Sacramento San Joaquin Delta Studies – Field Program to Measure Levee Erosion. Lorang Okanagan University College, British Columbia Canada , contract # 02-106-085, 2004, $14,175

Flathead Lake Erosion Control Projects Lorang Confederated Salish and Kootenai Tribes # M29458, 2004, $30,000

Using Multi-spectral imagery to Assess changes in hydraulic connectivity within the Wapato Floodplain Yakima River, Washington. Lorang, Grand Valley State University, Michigan , #M2004-514, 2004, $ 2,422

Summit Lake Paiute Reservation Discovery Trip Summit Lake Paiute Tribe, Nevada Lorang (9/03- 12/03), $3,011

Flathead Lake Erosion Control Projecs Lorang Confederated Salish and Kootenai Tribes (9/02- 9/03), $10,000

Flathead Lake Erosion Control Projects Lorang Confederated Salish and Kootenai Tribes (9/03- 9/04), $45,000

Blue Bay Gravel Beach Erosion Control Project: Phase 1 Lorang Confederated Salish and Kootenai Tribes. (6/02-9/02), $15,975,

Wolf Point Gravel Beach Erosion Control Project Phase 1 Lorang Confederated Salish and Kootenai Tribes. (6/02-9/02) $2,585

Assessing Lake Wide Shoreline Erosion Lorang, Meites, Mulder Burger and Mollica (9/01-10/03) $14,776

B. GRANTS as Co-Principal Investigator/Co-Project Director ($10,577,643)

Mathematical methods for habitat classification of remote sensing imagery from river floodplains Bardsley and Lorang NSF-EPSCoR Large River Ecosystems Grant EPS-0701906– continued to 5/18/10. $58,000, continued funding for Marylesa Wilde, PhD student in Math department.

T*he Salmonid Rivers Observatory Network: Relating Habitat and Quality to Salmon Productivity for Pacific Rim Rivers*, Stanford PI, Hauer, Kimball, Lorang, Poole Co-PI's, Gordon and Betty Moore Foundation (Grant Award Letter Agreement #344.01), 4/1/07-3/31/10**,** $4,600,000. continued funding.

Hierarchical Typology of North Pacific Rim Rivers and Application to Wild Salmon Conservation, Stanford PI, Hauer, Kimball, Lorang, Poole Co-PI's, Gordon and Betty Moore Foundation (Grant Award Letter Agreement #739), 7/13/05-5/1/08, $1,659,533

REU Supplement: Biocomplexity-Dynamic Controls on Emergent Properties of River Flood Plains. NSF Stanford, McKee, Hauer, Lorang, Kimball, UM# M25662, (6 /0 4 - 5 /0 7) $220,575

Monitoring of Ecological Effects of Ecologically Based System Management Flows Hauer and Lorang, US Bureau of Reclamation (1/05 12-06) $85,000

Predicting Ecosystem Response to the Removal of the Elwha River Dams, Washington State Hauer and Lorang, National Park Service, UM# M25171 (1-05–12/05), $41,250

Biocomplexity – Dynamic Controls on Emergent Properties of River Flood Plains Stanford, Hauer, Lorang, Kimball, Callaway and Woessner, , NSF Grant # M25586 (10/01 –9/05) $2,600,000.

Biologically Based System Management Assessment and Management Plan for the Snake River from Henry's Fork to Shelley Reach Hauer and Lorang US Bureau of Reclamation # M25084 (9/03-12/04) $150,000

Biologically Based System Management Assessment and Management Plan for the Snake River from Shelley Reach to the Blackfoot River, Hauer and Lorang US Bureau of Reclamation, M24956 (9/03-12/04) $164,000

Lower Boise River Assessment, Hauer and Lorang US Bureau of Reclamation M24956 (9/03-12/04) $51,485

Hyperspectral Imagery Acquisition & Analysis of Elwha River Corridor, Hauer and Lorang, National Park Service Grant # 25171 (9/03-12/04) $41,250

REU Supplement: Biocomplexity-Dynamic Controls on Emergent Properties of River Flood Plains. Stanford, McKee, Hauer, Lorang, Kimball (9/03-12/06) NSF Grant # M25630, $180,000.

Linking Remote Sensing and floodplain ecology of the Snake River, Idaho and Wyoming: Development of biologically based system management information Heise to Mann. Hauer and Lorang, US Bureau of Reclamation (10/02-9/03), $104,266,

Floodplain ecology of the Snake River, Idaho and Wyoming: Development of biologically based system management information. Hauer, Lorang and Stanford, US Bureau of Reclamation (9/00-9/03) $622,284,

Professional Reports

Lorang, M,S. 2014. *North Shore Erosion Control, Monitoring and Wetland Restoration2010 through 2014 Final Report for PPL Montana*.

R.T. Kneib ,Anderson, J.J., J,A, Gore, , M.S. Lorang, J.M. Nestler and J. Van Sickle. 2013. *Report of the 2013 Independent Review Panel (IRP) on the Long-term Operations Biological Opinions (LOBO_ Annual Review.* Final report submitted to the Delta Stewardship Council (report can be found on the Delta Science Program web page: http://deltacouncil.ca.gov/event-detail/3877)

Lorang, M,S. 2013. *2013 Final North Shore Flathead WPA Erosion Control Project Completion Report to PPL Montana.*

Anderson, J.J., J,A, Gore, R.T. Kneib, M.S. Lorang and J. Van Sickle. 2012. Report *of the 2012 Independent Review Panel (IRP) on the Implementation of Reasonable and Prudent Alternative (RPA) Actions Affecting the Operations Criteria And Plan (OCAP) for State/Federal Water Operations*. Final report submitted to the Delta Stewardship Council (report can be found on the Delta Science Program web page: http://deltacouncil.ca.gov/event-detail/3877)

Anderson, J.J., J,A, Gore, R.T. Kneib, M.S. Lorang and J. Van Sickle. 2011. Report *of the 2011 Independent Review Panel (IRP) on the Implementation of Reasonable and Prudent Alternative (RPA) Actions Affecting the Operations Criteria And Plan (OCAP) for State/Federal Water*

Operations. Final report submitted to the Delta Stewardship Council (report can be found on the Delta Science Program web page: http://deltacouncil.ca.gov/event-detail/3877)

Bauer, B.O.,D.J., Sherman, M.S. Lorang, J.T. Ellis, M.D. Lange and F. Hopf, 2011. *The Temporal and Spatial Nature of Levee Erosion in the California Delta with Specific Reference to the Relative Role of Rrecreational Boating Traffic*, 1997-2009. Final Project report, California Department of Boating and Waterways.

Ellis, J.T., M.D. Lange, B.O.Bauer, M.S. Lorang and D.J. Sherman. 2011. *Assessing Levee Erosion in the Sacramento and San Joaquin River Delta*. Final Report submitted to California Department of Boating and Waterways.

Ellis, J.T., M.D. Lange, B.O.Bauer, M.S. Lorang and D.J. Sherman. 2010. *Assessing Levee Erosion in the Sacramento and San Joaquin River Delta*. Annual Report submitted to California Department of Boating and Waterways

Ellis, J.T., M.D. Lange, B.O.Bauer, M.S. Lorang and D.J. Sherman. 2009. *Assessing Levee Erosion in the Sacramento and San Joaquin River Delta*. Annual Report submitted to California Department of Boating and Waterways

Ellis, J.T., M.D. Lange, B.O.Bauer, M.S. Lorang and D.J. Sherman. 2008. *Assessing Levee Erosion in the Sacramento and San Joaquin River Delta*. Annual Report submitted to California Department of Boating and Waterways.

Ellis, J.T., M.D. Lange, B.O.Bauer, M.S. Lorang and D.J. Sherman. 2007. *Assessing Levee Erosion in the Sacramento and San Joaquin River Delta*. Annual Report submitted to California Department of Boating and Waterways.

Lorang M.S. 2007. *Conceptual soft structure plan for the North Shore of Flathead Lake: Erosion control and nearshore aquatic/wetland habitat restoration*. Final design report submitted to PPL-MT. 29 pp.

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