

Trent W. Biggs

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Research

Impact of humans on watershed processes, including water balances, sediment budgets, channel morphology, and water quality. Study sites include American Samoa, Tijuana, San Diego, California Central Valley, southern India, and the Indian Himalaya. Techniques include remote sensing of land cover, evapotranspiration, terrain (3D photo reconstruction), modelling, and fieldwork for channel geometry, streamflow, and water quality characterization.

Professional Academic Experience

2015-Present	Professor of Geography, San Diego State University
2010-2015	Associate Professor of Geography, San Diego State University
2007-2010	Assistant Professor of Geography, San Diego State University
2003-2005	Postdoctoral Scholar, International Water Management Institute

Education

2003	PhD, University of California, Santa Barbara, Geography
2000	MA, University of California, Santa Barbara, Geography
1995	A.B., Princeton University, Ecology and Evolutionary Biology

Peer-reviewed Journal Articles * indicates student co-author

39. Hess, T. M., Sumberg, J., **Biggs, T. W.**, Georgescu, M., Haro-Montegudo, D., Jewitt, G., Ozdogan, M., Marshall, M., Thenkabail, P., Daccache, A., Knox, J. W. (in press). A sweet deal? Sugarcane, water and agricultural transformation in Sub-Saharan Africa. *Global Environmental Change*.
38. *Beland, M., Roberts, D. A., Peterson, S. H., **Biggs, T. W.**, Kokaly, R. F., Piazza, S., Ustin, S. L. (in press). Mapping changing distributions of dominant species in oil-contaminated salt marshes of Louisiana using imaging spectroscopy. *Remote Sensing of Environment*.
37. *Messina, A. T., and **Biggs, T. W.** (in press). Contributions of human activities to suspended sediment yield during storm events from a small, steep, tropical watershed. *Journal of Hydrology*.
36. Marshall, M., Thenkabail, P., **Biggs, T.**, and Post, K. 2016. Hyperspectral narrowband and multispectral broadband indices for remote sensing of crop evapotranspiration and its components (transpiration and soil evaporation). *Agricultural and Forest Meteorology*, 218–219, 122–134. <http://dx.doi.org/10.1016/j.agrformet.2015.12.025>

35. *Taniguchi, K. T., & **Biggs, T. W.** 2015. Regional impacts of urbanization on stream channel geometry: A case study in semiarid southern California. *Geomorphology*, 248, 228–236. <http://doi.org/10.1016/j.geomorph.2015.07.038>
34. **Biggs, T. W.**, C.-T. Lai, P. Chandan, R. M. Lee*, A. Messina*, R. S. Leshner*, and N. Khatoon. 2015. Evaporative fractions and elevation effects on stable isotopes of high elevation lakes and streams in arid western Himalaya, *J. Hydrol.*, 522(0), 239–249, doi:<http://dx.doi.org/10.1016/j.jhydrol.2014.12.023>.
33. *Lee, R. M., and **T. W. Biggs.** 2014. Impacts of land use, climate variability, and management on thermal structure, anoxia, and transparency in hypereutrophic urban water supply reservoirs, *Hydrobiologia*, 1–22, doi:10.1007/s10750-014-2112-1.
32. **Biggs, T.W.**, *Anderson, W.G., Pombo, O.A., 2014. Concrete and Poverty, Vegetation and Wealth? A Counterexample from Remote Sensing of Socioeconomic Indicators on the U.S.–Mexico Border. *Professional Geographer* 1–14. doi:10.1080/00330124.2014.905161.
31. *Wang N, **Biggs T.W.**, Skupin A. 2013. Visualizing gridded time series data with self-organizing maps: An application to multi-year snow dynamics in the Northern Hemisphere. *Comp. Env. Urban Sys.* DOI: <http://dx.doi.org/10.1016/j.compenvurbsys.2012.10.005>.
30. **Biggs, T.W.** and *Whitaker, T., 2012. Critical elevation zones of snowmelt during peak discharges in mountain river basins. *Journal of Hydrology*. 438-439: 52-65
29. **Biggs, T.W.** and *D'Anna, H., 2012. Rapid increase in copper concentrations in a new marina, San Diego Bay. *Marine Pollution Bulletin*, 64(3): 627-635.
28. Neill C, Chaves J, **Biggs T**, Deegan L, Elsenbeer H, Figueiredo R, Germer S, Johnson M, Lehmann J, Markewitz D & Piccolo M. 2011. Runoff sources and land cover change in the Amazon: an end-member mixing analysis from small watersheds. *Biogeochemistry* 105: 7-18
27. Bouma, J.A., **Biggs, T.W.** and Bower, L.M., 2011. The downstream externalities of harvesting rainwater in semi-arid watersheds: An Indian case study. *Agricultural Water Management*, 98(7): 1162-1170.
26. Chatterjee, A., E. Blom, B. Gujja, R. Jacimovic, L. Beevers, J. O'Keeffe, M. Beland, and **T. Biggs.** 2010. WWF Initiatives to Study the Impact of Climate Change on Himalayan High-altitude Wetlands (HAWs). *Mountain Research and Development* 30 (1):42-52.
25. Van Rooijen, D., **Biggs, T.**, Smout, I. and Drechsel, P. 2010. Urban growth, wastewater production and use in irrigated agriculture: a comparative study of Accra, Addis Ababa and Hyderabad. *Irrigation and Drainage Systems* 24: 53–64, doi 10.1007/s10795-10009-19089-10793.
24. Venot J-P, Jella K, Bharati L, George B, **Biggs T**, Rao PG, Gumma MK, & Acharya S. 2010. Farmers' Adaptation and Regional Land-Use Changes in Irrigation Systems under

Fluctuating Water Supply, South India. *Journal of Irrigation and Drainage Engineering* **136**, 595-609. §§

23. **Biggs, T.W.**, *Atkinson, E., Powell, R. and Ojeda, L., 2010. Land cover following rapid urbanization on the US-Mexico border: Implications for conceptual models of urban watershed processes. *Landscape and Urban Planning*, doi:10.1016/j.landurbplan.2010.02.005. §
22. **Biggs, T.W.**, Gangadhara Rao, P. and Bharati, L., 2010. Mapping agricultural responses to water supply shocks in large irrigation systems, southern India. *Agricultural Water Management*, 97(6): 924-932, doi:10.1016/j.agwat.2010.01.027. §
21. **Biggs, T. W.**, and B. Jiang. 2009. Soil Salinity and Exchangeable Cations in a Wastewater Irrigated Area, India. *Journal of Environmental Quality* 38 (3):887-896.
20. Van Rooijen, D. J., H. Turrall, and **T. W. Biggs**. 2009. Urban and industrial water use in the Krishna Basin, India. *Irrigation and Drainage* 58 (4):406-428.
19. Lee, E., Chase, T.N., Rajagopalan, B., Barry, R.G., **Biggs, T.W.** and Lawrence, P.J., 2009. Effects of irrigation and vegetation activity on early Indian summer monsoon variability. *International Journal of Climatology*: 29 (4):573-581, doi 10.1002/joc.1721.
18. **Biggs, T. W.**, C. A. Scott, A. Gaur, J.-P. Venot, T. Chase, and E. Lee. 2008. Impacts of irrigation and anthropogenic aerosols on the water balance, heat fluxes, and surface temperature in a river basin. *Water Resources Research* 44: 10.1029/2008WR006847.
17. Van Rooijen, D., H. Turrall, and **T.W. Biggs**. 2008. Urban and industrial water use in the Krishna Basin, India. *Irrigation and Drainage* online:10.1002/ird.439.
16. Venot, J.-P., **T. Biggs**, F. Molle, and H. Turrall. 2008. Reconfiguration and closure of river basins in south India: trajectory of the lower Krishna basin. *Water International* 33 (4):436 - 450.
15. **Biggs, T.W.**, P.K. Mishra, and H. Turrall. 2008. Evapotranspiration and regional probabilities of soil moisture stress in rainfed crops, southern India. *Agricultural and Forest Meteorology* 148:1585-1597.
14. **Biggs, T.W.**, Dunne, T., Roberts, D.L., Matricardi, E., 2008. The rate and extent of deforestation in watersheds of the southwestern Amazon Basin. *Ecological Applications*. 18: 31-48.
13. Gaur, A., **Biggs, T.W.**, Gumma, M.K., Parthasaradhi, G. and Turrall, H., 2008. Water scarcity effects on equitable water distribution and land use in a major irrigation project--case study in India. *Journal of Irrigation and Drainage Engineering*, 134(1): 26-35.
12. Bouwer, L.M., **Biggs, T.W.**, Aerts, J.C.J.H. 2008. Estimates of spatial variation in evaporation using satellite-derived surface temperatures and a water balance model. *Hydrological Processes* 22: 670-682.

11. **Biggs, T.W.**, A. Gaur, C.A. Scott, P. Thenkabail, R. Gangadhara Rao, M. Krishna Gumma, S.K. Acharya, and H. Turrall. 2007. Closing of the Krishna Basin: Irrigation development, streamflow depletion, and macroscale hydrology. *Research Report 111*. International Water Management Institute, Colombo, Sri Lanka.
10. Thenkabail, P., Parthasaradhi, G., **Biggs, T.W.**, Gumma, M.K., Turrall, H. 2007. Spectral Matching Techniques to Determine Historical Land use/Land cover (LULC) and Irrigated Areas using Time-series AVHRR Pathfinder Datasets in the Krishna River Basin, India. *Photogrammetric Engineering & Remote Sensing*, 73: 1029-1040.
9. **Biggs, T.W.**, Scott, C.A., Rajagopalan, B. and Turrall, H., 2007, Trends in solar radiation due to clouds and aerosols, Krishna River Basin, Southern India, 1952-1997. *International Journal of Climatology*, 27: 1505-1518.
8. **Biggs, T. W.**, P. S. Thenkabail, M.K. Gumma, C. Scott, G. R. Parthasaradhi, and H. Turrall. 2006. Irrigated area mapping in heterogeneous landscapes using MODIS time-series, ground surveys, and agricultural census data in Krishna River Basin, India. *International Journal of Remote Sensing* 10: 4245-4266.
7. **Biggs, T. W.**, T. Dunne, and T. Muraoka. 2006. Transport of water, solutes, and nutrients from a pasture hillslope, southwestern Brazilian Amazon. *Hydrological Processes* 20: 2527-2547.
6. Ahmad, M., **T. W. Biggs**, H. Turrall, and C. Scott. 2006. Application of SEBAL Approach to Map the Agricultural Water Use Patterns in the Data Scarce Krishna River Basin of India. *Water Science and Technology* 53: 83-90.
5. Van Rooijen D., Turrall H., **Biggs T.W.** 2005. Sponge City: Water balance of mega-city water use and wastewater use in Hyderabad, India. *International Council on Irrigation and Drainage Wastewater Irrigation Special Issue*.
4. **Biggs, T. W.**, T. Dunne, and L. A. Martinelli. 2004. Natural controls and human impacts on stream nutrient concentrations in a deforested region of the Brazilian Amazon basin. *Biogeochemistry* 68:227-257.
3. Holmes, K., D.A. Roberts, S. Sweeney, I. Numata, E. Matricardi, O.A. Chadwick, **T.W. Biggs**, G. Batista. 2004. Soil databases and the problem of establishing regional biogeochemical trends. *Global Change Biology*, 10, 796-814.
2. **Biggs, T.W.**, T. Dunne, T.F.Domingues, and L.A.Martinelli. 2002. The relative influence of natural watershed properties and human disturbance on stream solute concentrations in the southwestern Brazilian Amazon basin. *Water Resources Research* 38:doi 10.1029/2001WR000271.

1. Richey, J.E., Krusche, A., Deegan, L., Ballester, V., **Biggs, T.** and Victoria, R., 2001, Land use changes and the biogeochemistry of river corridors in the Amazon. *International Geosphere-Biosphere Programme, Global Change News Letter*, **45**, pp. 19-22.

Refereed Book Chapters

3. **Biggs, T.**, Petropoulos, G., Velpuri, N., Marshall, M., Glenn, E., Nagler, P., & Messina, A. 2015. Remote Sensing of Actual Evapotranspiration from Croplands. In *Remote Sensing of Water Resources, Disasters, and Urban Studies* (pp. 59–99). CRC Press.
<http://doi.org/10.1201/b19321-6>
2. Van Rooijen, D.J., Smout, I., Drechsel, P., **Biggs, T.W.**, 2014. 16. Wastewater treatment capacity, food production and health risk in peri-urban areas: A comparison of three cities, in: Maheshwari, B., Purohit, R., Malano, H., Singh, V.P., Amerasinghe, P. (Eds.), *The Security of Water, Food, Energy and Liveability of Cities*. Springer, Dordrecht.
doi:10.1007/978-94-017-8878-6
1. **Biggs, T. W.** (2013, *invited*). 11.2 Hydrologic insights from long term runoff patterns across Krishna Basin, India. Prediction in Ungaged Basins: Synthesis. G. Bloschl, M. Sivapalan, T. Wagener and H. H. G. Savenije, Cambridge University Press.

Peer-reviewed technical reports

1. Holst-Rice, S., A. Messina, **T. Biggs**, B. Vargas-Angel, and D. Whittall. 2016. *Baseline Assessment of Faga'alu Watershed: A Ridge to Reef Assessment in Support of Sediment Reduction Activities and Future Evaluation of their Success*. Silver Spring, MD: NOAA Coral Reef Conservation Program. NOAA Technical Memorandum CRCP 23. 44 pp. DOI: 10.7289/V5BK19C3

Conference Abstracts (2010-present only)

Taniguchi, K., N. Gudino, **T. Biggs**, C. Castillo, E. Langendoen, R. Bingner, E. Taguas, D. Liden, and Y. Yuan. 2015. Trans-border hydrology and sediment budget of Los Laureles Canyon, Tijuana, MX: Towards impact assessment and mitigation, Association for Environmental Studies and Sciences (AESS) Annual Conference, San Diego, CA, June 2015.

Taniguchi, K., N. Gudino, **T. Biggs**, C. Castillo, E. Langendoen, R. Bingner, E. Taguas, D. Liden, and Y. Yuan. 2015. Goat Canyon Sediment Model, Tijuana River Valley Recovery Team Meeting, San Diego, CA, June 2015.

Taniguchi, K., N. Gudino, **T. Biggs**, C. Castillo, E. Langendoen, R. Bingner, E. Taguas, D. Liden, and Y. Yuan. 2015. Hydrology and sediment budget of Los Laureles Canyon, Tijuana, MX: Modelling channel, gully, and rill erosion with 3D photo-reconstruction, CONCEPTS, and AnnAGNPS, European Geosciences Union (EGU) General Assembly, Vienna, Austria, April 2015.

Taniguchi, K. and **T. Biggs**. 2015. Regional impacts of urbanization on stream channel geometry: Importance of watershed area and channel particle size, SDSU Student Research Symposium, San Diego, CA, March 2015. [Won Library Research Excellence Award]

Messina, A., **Biggs, T.**, 2014, *Contributions of human activities to suspended-sediment yield during storm events from a steep, small, tropical watershed, American Samoa*, Poster Presentation, American Geophysical Union, San Francisco, CA.

Biggs, T.W. 2014. Sediment and the Tijuana Estuary. Regional Advisory Committee Meeting #47, San Diego Integrated Regional Water Management, San Diego County Water Authority. February 5, 2014.

Biggs, T.W., Marshall, M.T., Melton, F.S., Lund, C., Adhikari, D., Anderson, F., 2013. Global evapotranspiration datasets: (*invited oral presentation*), in: American Geophysical Union, Fall Meeting. San Francisco, CA. December 2013.

Biggs, T.W., Gumma, M.K., Scott, C.A., 2013. Are small reservoirs important? The regional sociohydrology and climatic sensitivity of irrigation systems in southern India (*invited oral presentation*), in: American Geophysical Union Fall Meeting. San Francisco, CA. December 2013.

Biggs, T.W., Messina, A., 2013 Global ET datasets: Comparison with automated SEBAL in irrigated and rainfed ecosystems, in: Association of American Geographers (*oral presentation*). Los Angeles, CA. April 2013.

Biggs, T.W., Lee, R., Messina, A., Chandan, P., 2012. Lapse rates in the Himalaya: Insights from MODIS and in-situ data loggers (*oral presentation*), in: American Geophysical Union Fall Meeting. San Francisco, CA. December, 2012.

Biggs, T.W., Wiles, P., Wetzell, L., 2011. Sediments and water quality in Faga'alu Watershed, in: Coral Reef Advisory Group of American Samoa (*oral presentation*). Pago Pago, American Samoa. July 2011.

Biggs, T.W., Perkins, E., 2010. The Green Revolution, hydrology, and surface climate: observations from the Krishna Basin, Southern India, in: Hydrology Conference 2010. San Diego, CA. October 2010.

Funded Research Grants

19. Effectiveness of mitigation of sediment loads to coral reefs. \$46,332

August 2015-December 2016

PI: Biggs, Funding Agency: National Fish and Wildlife Foundation

18. Assessing water quality and sources of nutrient loads in American Samoa watersheds.

\$33,866. June 2015 to May 2016.

PI: Biggs, Funding Agency: American Samoa Department of Interior

17. Final model development for hydromodification in San Diego County. \$16,000

February 2015-June 2015.

PI: Biggs, Funding Agency: County of San Diego

16. Hydro-social and environmental impacts of sugarcane production. \$36,613

Aug 2014-July 2016.

PI: T. Hess, Cranfield University; Funding Agency: NSF and Belmont Forum

- 15. Mapping oil-affected vegetation in the Gulf Coast.** \$54,449
Sept, 2013 – Aug 2015.
PI: Biggs, Funding Agency: NASA Earth System Science Graduate Student Fellowship to Michael Beland
- 14. Sediment and hydrologic modeling of Los Laureles Canyon, Tijuana.** \$73,000
Jan 1, 2014-Sept 1, 2017.
PI: Biggs, Funding Agency: US Environmental Protection Agency
- 13. Hydrologic modeling to support Hydromodification in San Diego County.** \$16,000
Sept 2013-June 2014.
PI: Biggs, Funding Agency: County of San Diego
- 12. Monitoring sediment loading to the Tijuana Estuary.** \$16,000
December 2013.
PI: Biggs, Funding Agency: US Environmental Protection Agency
- 11. Stormflow and water quality in San Diego County** \$9939
January 2013 - June, 2014.
PI: Biggs, Funding Agency: University Grants Program
- 10. Sedimentation on coral reefs in American Samoa,** Nov 2013-Apr 2015. \$55,119.
PI: Biggs, Funding Agency: NOAA Coral Reef Conservation Program
- 9. Sediment and nutrient loading to reefs in American Samoa,** Oct 2013-Sept 2015, \$63,712
PI: Biggs, Funding Agency: Department of Commerce, American Samoa
- 8. Watershed modeling of sediment and nutrient load to a coral reef, American Samoa**
Oct 2011-Oct 2013, \$47,000
PI: Biggs, Funding agency: NOAA Territorial Grant
- 7. High altitude wetlands of the Himalaya,** May 2009-January 2010, \$37,000
PI: Biggs, Funding agency: Worldwide Fund for Nature.
- 6. Sediment and erosion in urban Tijuana: Socioeconomic interactions with sediment budgets under rapid urbanization of marginal lands,** June 2008-August 2009, \$79,999.
PI: Biggs
Funding agency: Southwest Consortium for Environmental Research and Policy.
- 5. Urban landscapes and sediment production potential from Tijuana,** January 2008-May 2009. \$5100
PI: Biggs, Funding agency: University Grants Program, San Diego State University.
- 4. Particle size and accumulation rates of sediment within fluvial and feeder**

canyon depositional environments of the Tijuana Estuary Reserve, Fellowship award to Shannon Webber, June 2008-May 2009, \$20,000

PI: Biggs

Funding agency: National Estuarine Research Reserve, National Oceanic and Atmospheric Administration.

3. Water Allocation in the Krishna River Basin to Improve Water Productivity in Agriculture. 2004-2008, \$234,800

International Water Management Institute

PI: C.A. Scott and H. Malano

Funding Agency: Australian Council for International Agricultural Research.

Collaborators: University of Melbourne, and Jawaharlal Nehru Technological University.

2. Large Scale Biosphere-Atmosphere Project in the Amazon (LBA). 1998-2003.

University of California, Santa Barbara.

PI: Dar Roberts and Oliver Chadwick.

Funding agency: NASA

Collaborators: Centro de Energia Nuclear na Agricultura, University of Sao Paulo.

1. Regional deforestation and stream biogeochemistry in the Amazon Basin. 2000-2003 \$64,000, NASA Graduate Student Research Fellowship.

University of California, Santa Barbara.

Current advising (Fall 2016)

PhD (2):

Michael Beland: Mapping vegetation and coastal change after the BP oil spill

Kris Taniguchi: Channel erosion and sediment budgets of urbanization in Tijuana

MS (6):

Lara Barrett: Climate change and monthly water balance

Luis de la Torre: Solute and nutrient transport in channelized and restored urban streams

Thomas Strand: Stream channel response to urbanization

Greg McCormick: Nutrient loading to the coast in American Samoa

Maegan Salinas: Mapping water use in the Coachella and Imperial Valleys

Yelena Granovskaya: Mapping agricultural land use change on the US-Mexico Border

Student theses completed (Committee Chair)

Alex Messina (2016, PhD): Watershed and coastal sediment interactions in American Samoa

Whitney Seymour (2016, MS): Transmission loss and groundwater recharge in the Mojave River

Alex Samarin (2015): Assessing sensitivity and exposure of irrigated agriculture to drought in the Krishna River Basin, India

Current position: GIS Analyst at IGIS Technologies

Taya Lazootin (2015): Retention and release of stream water and nutrients downstream of an urban center in San Diego County

Current position: CA Sea Grant Fellow, CA Department of Fish and Wildlife, Los Alamito

Kris Taniguchi (2014): Regional Impacts of Urbanization on Stream Channel Geometry

Current position: PhD student, SDSU-UCSB joint doctoral program

Raymond Lee (2014): Hydrologic, Climatological, and Biogeochemical Controls on Thermal Structure and Anoxia in Four Hypereutrophic Drinking Water Reservoirs

Current position: PhD student, Virginia Tech

Alex Messina (2012): Mapping drought in the Krishna Basin with remote sensing

Current position: PhD student, SDSU-UCSB joint doctoral program

Cleo Neculae (2011): Key controls of stream temperature in Rock Creek, Oregon: implications for restoration of riparian vegetation

Current position: University of Washington, Bothell

Rebecca Leshner (2011): Climate change impacts to a high altitude lake in the Indian Himalaya

Current position: Geologist at Oneida Total Integrated Enterprises (OTIE)

Emily Perkins (2011): Irrigation controls on atmospheric water vapor, southern India

Current position: Western Ecological Research Center, USGS

Heather D'Anna (2010): A spatial-temporal analysis of copper and zinc from antifouling paint in Pier 32 Marina, National City, California

Current position: Field Biologist at United Water Conservation District

Shannon Webber (2010): The role of local watersheds on sediment accumulation in the Tijuana Estuary Reserve

Participation in Professional Associations

Member, Association of American Geographers

Member, American Geophysical Union

Service for the University

S2014: Hiring (Chair), Computing, Curriculum, PhD Advising

F2012-S2013: Speakers (Chair), Policy Advisory, Hiring, Student Outcomes Assessment.

F2011-S2012: Speakers (Chair), Policy Advisory, Curriculum, Undergraduate Advising.

Co-Director, Sustainability Major and Environmental Studies, 2010-2014.

Student Research Symposium Committee. 2011-2012 and 2012-2013.

Global Brigades, Faculty Advisor, 2011-2012 and 2012-2013

SDSU Senate, 2010-2013

SDSU Senate Sustainability Committee, 2011-2013

Service for the Profession

Reviewer for:

NASA Land Cover Land Use Change Program (September 2010)
National Science Foundation, Geography and Regional Science (September 2010)
Water Resources Research; Journal of Hydrology
Journal of the American Water Resources Association; Ecological Applications
Environmental Research Letters; Biogeochemistry; Journal of Environmental Quality
Photogrammetric Engineering and Remote Sensing
International Journal of Remote Sensing
Hydrological Processes; Agricultural and Forest Meteorology
Hydrological Sciences; Journal of Hydrologic Engineering; Geography Compass
Journal of Spatial Hydrology; Soil Use and Management
Journal of Irrigation and Drainage Engineering
Cambridge Journal of Regions, Economy and Society; Atmosfera
Atmospheric Environment; Ecosphere
Journal of Land Use Science; Environmental Monitoring and Assessment
Vadose Zone; Freshwater Science; Remote Sensing; Water International; Groundwater