ADRIAN A. HARPOLD

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EDUCATION

1999 - 2003 Virginia Polytechnic Institute (Virginia Tech) Blacksburg, VA
- B.S. in Biological Systems Engineering, s*umma cum laude*

2003 - 2005 Virginia Polytechnic Institute Blacksburg, VA
- M.S. in Biological Systems Engineering, thesis title: "Stream discharge measurement using a large-scale particle velocimetry prototype"

2005 - 2010 Cornell University Ithaca, NY
- Ph.D. in Biological and Environmental Engineering, dissertation title: "Hydrogeomorphological controls on stream chemistry and aquatic biota in the Catskill Mountains, New York State"

RESEARH AND TEACHING EXPERIENCE

2014 - present Natural Resources and Env. Science, University of Nevada Reno, NV
Assistant Professor
- Teaching and lead of the Nevada Mountain Ecohydrology Lab

2012 - 2014 INSTAAR, University of Colorado and NCAR Boulder, CO
Postdoctoral Research Fellow
- Improving representations of snow-vegetation interactions in land-surface models

2010 - 2012 Hydrology and Water Resources Dept., University of Arizona Tucson, AZ
Postdoctoral Researcher
- Jemez River Critical Zone Observatory and impacts of pine beetles in the Rocky Mountains

2005 - 2010 Biological and Env. Engineering Dept., Cornell University Ithaca, NY
Graduate Research Fellow
- Funded by the National Science Foundation

2003 - 2005 Biological Systems Engineering Dept., Virginia Tech Blacksburg, VA
Graduate Teaching Assistant
- Departmental assistantship for teaching an undergraduate thermodynamics course

AWARDS AND LEADERSHIP POSITIONS

- College of Agriculture, Biotechnology and Natural Resources, Outstanding Researcher, 2019
- Haury Fellow, University of Arizona Laboratory of Tree Ring Research, 2019
- Outstanding Faculty Member: UNR Graduate Program in Hydrologic Sciences (GPHS), 2016
- National Science Foundation EAR Postdoctoral Fellowship, 2012 - 2014
- NSF Graduate Research Fellowship (GRFP), 2005 - 2009
- Virginia Conservationist of the Year, Soil and Water Conservation Society (SWCS), 2005
- President Student Chapter of SWCS, 2003 - 2004
- *Summa cum laude*, B.S., 2003
- NSF Research Experience for Undergraduates (REU) Fellowship, 2002
- Virginia Tech Biological Systems Engineering Sophomore of the Year, 2002

PROFESSIONAL SOCIETIES AND TRAINING

American Geophysical Union (AGU), Critical Zone Exploration Network (CZEN), International Association of Hydrological Sciences (IAHS), Nevada Water Resources Associate (NWRA), AGU-Ecohydrology Technical Committee member

Alpha Epsilon Honor Society, Phi Kappa Phi Honor Society, Golden Key Honor Society, National Society of Collegiate Scholars

Engineer-in-Training (EIT) in the State of Virginia 2003, graduate of University of Aberdeen Catchment Science School 2010, participant NCAR Community Land Model course 2014, SERC Early Career workshop graduate 2015, ACUE teaching course graduate 2017

PUBLICATIONS

#graduate student author directly supervised by Harpold, $undergraduate student author directly supervised by Harpold, @ post-doctoral scientist directly supervised by Harpold, *student author co-supervised by Harpold

44. Hammond, J.C., Harpold, A.A., Weiss, S., and Kampf, S.K.: Partitioning snowmelt and rainfall in the critical zone: effects of climate type and soil properties, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-98, accepted for publication (**ISI IF=4.4**)
43. Bloschl, G., and 229 co-authors including A.A. Harpold. Twenty-three unsolved problems in hydrology (UPH) – a community perspective. (2019) *Hydrological Sciences Journal*. 64:10, 1141-1158. doi: 10.1080/02626667.2019.1620507 (**ISI IF=2.2**)
42. Kostadinov@, T.S. R. Schumer, M. Hausner, K. J. Bormann, R. Gaffney, K. McGwire, T. H. Painter, S. Tyler, and A.A. Harpold. Watershed-scale mapping of fractional snow cover under forest canopy using lidar. *Remote Sensing of Environment*. 222: 34-49. doi: 10.1016/j.rse.2018.11.037 (**ISI IF=6.5**)
41. Petersky#, R., K. Shoemaker, P. Weisberg, and A.A. Harpold. The sensitivity of snow ephemerality to warming climate across an arid to montane vegetation gradient. *Ecohydrology*. doi: 10.1002/eco.2060 (**ISI IF=4.4**)
40. Petersky#, R., and A.A. Harpold. Now you see it, now you don't: Characterizing ephemeral snowpacks and soil moisture response using the Great Basin, USA as a case study. (2018) *Hydrology and Earth Systems Sciences* 22: 4891-4906. doi: 10.5194/hess-22-4891-2018 (**ISI IF=4.4**)
39. Karwan, D.L., J.E. Pizzuto, R. Aalto, J. Marquard, A. Harpold, K. Skalak, A. Benthaem, D.F. Levia, C.M. Siegert, and A. Aufdenkampe. (2018) Event-scale suspended sediment age influenced by hydrologic flux in a mixed-land use Mid-Atlantic Watershed, USA. *Water Resources Research*. 54. doi: 10.1029/2017WR021684 (**ISI IF=4.4**)
38. Perdrial, J., P. Brooks, T. Swetnam, K.A. Lohse, C. Rasmussen, M. Litvak, A.A. Harpold, X. Zapata-Rios, P. Broxton, B. Mitra, T. Meixner, K. Condon, D. Huckle, C. Stielstra, A.Vazquez-O, M. Holleran, C. Orem, J. Pelletier, and C. Chorover. (2018) A net ecosystem carbon budget for snow dominated forested headwater catchments: linking water and carbon fluxes to critical zone carbon storage. *Biogeochemistry*. doi: 10.1007/s10533-018-0440-3 (**ISI IF=3.4**)
37. Harpold, A.A. and P.D. Brooks. Humidity Determines Snowpack Ablation Under a Warming Climate. (2018) *Proceedings of the National Academy of Sciences*. doi: 10.1073/pnas.1716789115 (**ISI IF=9.7**)

- Press Release: https://phys.org/news/2018-01-climate-snowmeltturn-humidity.html

36. Harpold, A.A. and M. Kohler$. (2017) Potential For Changing Extreme Snowmelt And Rainfall Events in the Mountains of the Western United States. *Journal of Geophysical Research: Atmospheres*. doi: 10.1002/2017JD027704 (**ISI IF=3.5**)

- EoS Research Spotlight: https://eos.org/research-spotlights/how-does-snow-affect-the-intensity-of-mountain-precipitation

35. Harpold, A.A., S. Rajagopal, J. Crews, T. Winchell, and R. Schumer. (2017) Relative humidity has uneven effects on shifts from snow to rain over the western U.S. *Geophysical Research Letters*. doi: 10.1002/2017GL075046 (**ISI IF=4.3**)

34. Tennant*, C. J., Harpold, A. A., Lohse, K. A., Godsey, S. E., Crosby, B. T., Larsen, L. G., Brooks, P. D., Van Kirk, R. W. and Glenn, N.F. (2017) Regional sensitivities of seasonal snowpack to elevation, aspect, and vegetation cover in western North America. *Water Resources Research*. 53. doi: 10.1002/2016WR019374 (**ISI IF=4.4**)

- WRR Editor's Highlight https://agupubs.onlinelibrary.wiley.com/article/10.1002/2016WR019374/editor-highlight/

- WRR Editor's Choice Award (given to less than 1% of WRR papers)

33. Wymore, A., N.R. West, K. Maher, P.L. Sullivan, A.A. Harpold, D. Karwan, J.A. Marshall, J. Perdrial, D. Rempe, and L. Ma. (2017) Growing a Generation of International Critical Zone Scientists. *Earth and Planetary Science Letters*. doi: 10.1002/esp.4196 (**ISI IF=4.4**)
32. McIntosh, J.C., C. Schaumberg, J. Perdrial, A. Harpold, A. Vasquez-Ortega, C. Rasmussen, D. Vinson, X. Zapata-Rios, P. Brooks, T. Meixner, J. Pelletier, L. Derry, and J. Chorover. (2017) Geochemical evolution of the Critical Zone on variable time scales informs concentration-discharge relationships: Jemez River Basin Critical Zone Observatory. *Water Resources Research*. 53(5): 4169-4196. doi:10.1002/2016WR019712 (**ISI IF=4.4**)
31. Swetnam, T., Brooks, P., Harpold, A., Barnard, H., Gallo, E. (2017) Topographically-driven differences in energy and water constrain climatic control on forest carbon sequestration. *Ecosphere*. 8(4). doi: 10.1002/ecs2.1797 (**ISI IF=2.5**)
30. Harpold, A.A., M. Dettinger, and S. Rajagopal. Defining Snow Drought and Why it Matters. (2017) *EOS*. 98. https://doi.org/10.1029/2017EO068775
29. Harpold, A.A., M. Kaplan, Z. Klos*, T. Link, J. McNamara, R. Schumer, C. Steele, and S. Rajagopal. (2017) Rain or Snow: Processes, Observations, Prediction, and Research Needs For Hydrologic Sciences. *Hydrology and Earth System Sciences*. 20:1-22. doi: 10.5194/hess-20-1-2016 (**ISI IF=4.4**)
28. Harpold, A.A., K. Sutcliffe, J. Clayton, A. Goodbody, and S. Vazquez§. Can Soil Moisture Information Improve Operational Streamflow Forecasts In Snow-Dominated Watersheds? (2016) *Journal of the American Water Resources Association*. 1-18. doi: 10.1111/1752-1688.12490 (**ISI IF=1.7**)
27. Barnhart*, T. N.P. Molotch, B. Livneh, A.A. Harpold, J. Knowles, and D. Schneider*. Snowmelt Rate Dictates Streamflow. (2016) *Geophysical Research Letters*. 43. doi: 10.1002/2016GL069690 (**ISI IF=4.3**)

    - UNR press release: http://www.unr.edu/nevada-today/news/2016/snowpack-research
26. Rajagopal, S. and A.A. Harpold. (2016). Testing and Improving Temperature Thresholds for Snow and Rain Prediction in the Western United States. *Journal of American Water Resources Association*. 1-13. doi: 10.1111/1752-1688.12443 (**ISI IF=1.7**)
25. Harpold, A.A. (2016) Diverging Sensitivity of Soil Water Stress To Changing Snowmelt Timing in the Western U.S. *Advances in Water Resources*. 92: 116-129. Doi: 10.1016/j.advwatres.2016.03.017 (**ISI IF=3.3**)
24. Biederman*, J. A., Meixner, T., Harpold, A. A., Reed, D., Gutmann, E., Guan*, J., and Brooks, P. Bark beetle disturbance drives nitrogen loss comparable to clear-cut harvest, but riparian buffer zones protect headwater streams. (2016) *Journal of Geophysical Research, Biogeosciences*. 121. doi: 10.1002/2015JG003284 (**ISI IF=3.4**)
23. Biederman*, J.A., A. Somor*, A.A. Harpold, E. Gutmann, D.D. Breshears, P.A. Troch, D.J. Gochis, R.L. Scott, A.J.H. Meddens, and P.D. Brooks. Recent tree die-off has little effect on streamflow in contrast to expected increases from historical studies. (2015) *Water Resources Research*. 51, 9775–9789, doi: 10.1002/2015WR017401 (**ISI IF=4.4**)

    - AGU research spotlight in EOS Transactions 98. doi:10.1029/2016EO047593

    - WRR Editor's Choice Award (given to less than 1% of WRR papers)
22. Harpold, A.A. and N.P. Molotch. Sensitivity of Soil Water Availability to Changing Snowmelt Timing in the Western U.S. *Geophysical Research Letters*. 42. 10.1002/2015GL065855 (**ISI IF=4.3**)
21. Harpold, A. A., Marshall*, J. A., Lyon, S. W., Barnhart*, T. B., Fisher*, B. A., Donovan*, M., Brubaker, K. M., Crosby, C. J., Glenn, N. F., Glennie, C. L., Kirchner, P. B., Lam*, N., Mankoff, K. D., McCreight, J. L., Molotch, N. P., Musselman, K. N., Pelletier, J., Russo, T., Sangireddy*, H., Sjöberg*, Y., Swetnam, T., and West, N. (2015). Laser vision: lidar as a

transformative tool to advance critical zone science, *Hydrol. Earth Syst. Sci.*, 19, 2881-2897, doi:10.5194/hess-19-2881-2015. (**ISI IF=4.4**)

20. Harpold, A.A. (2015) "Use of LiDAR in Environmental Science." In *Oxford Bibliographies* in Environmental Science. Ed. Ellen Wohl. New York: Oxford University Press, forthcoming.
19. Knowles*, J.F., Harpold, A.A., Cowie, R., Zeliff*, M., Barnard, H.R., Burns, S.P., Blanken, P.D., Morse, J.F., and Williams, M.W. (2015), The relative contributions of alpine and subalpine ecosystems to the water balance of a mountainous, headwater catchment. *Hydrological Processes.* 29: 4794-4808. doi: 10.1002/hyp.10526. (**ISI IF=3.0**)
18. Harpold, A.A, N.P. Molotch, P.D. Brooks, R. Bales, M. Litvak, K. Musselman. And P. Kirchner. (2015) Snowmelt infiltration in mixed-conifer subalpine forests. *Hydrological Processes.* 29: 2782-2798. doi: 10.1002/hyp.10400 (**ISI IF=3.0**)
17. Vazquez-Ortega*, A., J. Perdrial, A.A. Harpold, X. Zapata, C. Rasmussen, J. McIntosh, M. Schaap, M.D. Amistadi, and J. Chorover. (2015) Rare earth elements as reactive tracers of biogeochemical weathering in the Jemez River Critical Zone Observatory. *Geochimica et Cosmochimica Acta.* doi: 10.1016/j.chemgeo.2014.10.016 (**ISI IF=4.3**)
16. Broxton*, P., A.A. Harpold, J. Biederman*, P.D. Brooks, P.A. Troch, and N.P. Molotch. (2015) Quantifying the effects of vegetation structure on wintertime vapor losses from snow in mixed-conifer forests. *Ecohydrology*. doi: 10.1002/eco.1565 (**ISI IF=2.9**)
15. Harpold, A.A., Q. Guo, N. Molotch, P. Brooks, R. Bales, J.C. Fernandez-Diaz, K.N. Musselman, T. Swetnam*, P. Kirchner*, M. Meadows, J. Flannagan*, and R. Lucas*. (2014) A LiDAR derived snowpack dataset from mixed conifer forests in the Western U.S. *Water Resources Research*. 50(3): 2749-2755. doi: 10.1002/2013WR013935 (**ISI IF=4.4**)
14. Harpold, A.A., J. Biederman*, K. Condon*, M. Merino*, Y. Korganokar*, T. Nan*, L.L. Sloat*, M. Ross*, and P.D. Brooks. (2014) Changes in winter season snowpack accumulation and ablation following the Las Conchas Forest Fire. *Ecohydrology*. 7: 440-452. doi: 10.1002/eco.1363. (**ISI IF=2.9**)
13. Biederman, J.A., A.A. Harpold, D. Reed, D. Gochis, B. Ewers, E. Gutmann, and P.D. Brooks. (2014) Increased evaporation following widespread tree mortality limits streamflow response. *Water Resources Research*. 50, 5395–5409, doi:10.1002/2013WR014994. (**ISI IF=4.4**)
12. Biederman, J., P.D. Brooks, A.A. Harpold, D. Gochis, E. Gutman, D. Reed, E. Pendall, and B. Ewers. (2014) Multi-scale Observations of Snow Accumulation and Peak Snowpack Following Widespread, Insect-induced Lodgepole Pine Mortality. *Ecohydrology*. doi:10.1002/eco.1342. (**ISI IF=2.9**)
11. Perdrial, J. McIntosh, A.A. Harpold, P.D. Brooks, X. Zapata-Rios, J. Ray, T. Meixner, T. Kanduc, M. Litvak, P. Troch, and J. Chorover. (2014) Stream water carbon controls in seasonally snow-covered mountain catchments: impact of interannual variability of water fluxes, catchment aspect and seasonal processes. *Biogeochemistry*. 118:273. doi:10.1007/s10533-013-9929-y (**ISI IF=3.4**)
10. Sorooshian, A.S., T.S. Shingler, A.A. Harpold, C.W. Feagles, T.M. Meixner, and P.D. Brooks. (2013) Aeresol and Precipitation Chemistry in the Southwestern United States: Spatiotemporal Trends and Interrelationships. *Atmospheric Chemistry and Physics*. 13: 7361-7379. doi:10.5194/acp-13-7361-2013 (**ISI IF=5.3**)
9. Harpold, A.A., P.D. Brooks, S. Rajogopalan*, I. Heidebuchel*, A. Jardine*, and C. Stielstra*. Changes in snowpack volume and snowmelt timing in the Intermountain West. (2012) *Water Resources Research*. 48:11. doi: 10.1029/2012WR011949 (**ISI IF=4.4**)
   - **AGU research spotlight in EOS Transactions 94(28). doi:10.1002/2013EO020012**
8. Perdrial, J., N. Perdrial, A.A. Harpold, X. Gao, K. LaSharr, J. Chorover. (2012) Probing dissolved organic matter in the critical zone: a comparison between in situ passive capillary wick samplers (PCaps) to aqueous soil extracts. *Soil Science Society of America Journal*. 76(6): 2019-2030. doi:10.2136/sssaj2012.0061 (**ISI IF=1.9**)
7. Chorover, J., P.A. Troch, C. Rasmussen, P.D. Brooks, J.D. Pelletier, D.D. Breshears, T.E. Huxman, S.A. Kurc, K.A. Lohse, J.C. McIntosh, T. Meixner, M.G. Schaap, M.E. Litvak, J. Perdrial, A.A. Harpold, M. Durcik. (2011) Probing how water, carbon, and energy driven landscape evolution and surface water dynamics: Jemez River Basin – Santa Catalina

Mountains Critical Zone Observatory. *Vadose Zone Journal*. 10(3): 884-899. doi:10.2136/vzj2010.0132 (**ISI IF=1.9**)

6. Harpold, A.A., D.A. Burns, M.T. Walter, and T. Steenhuis. (2010) Explaining the spatial variability of aquatic biota using watershed features in the Neversink River watershed, New York, USA. *Ecological Applications*. 23: 791-800. doi: 10.1890/12-0603. (**ISI IF=4.3**)
5. Harpold, A.A., S.B. Shaw, D.A. Burns, M.T. Walter, and T. Steenhuis. (2010) Relating hydrogeomorphologic properties to stream buffering chemistry in the Neversink River watershed, New York, USA. *Hydrological Processes*. 24(26): 3759-3771. doi:10.1002/hyp.7802 (**ISI IF=3.0**)
4. Harpold, A.A., S.W. Lyon, P.A. Troch, and T.S. Steenhuis. (2009) The hydrological effects of lateral preferential flow paths in a glaciated watershed in the Northeastern U.S. *Vadose Zone Journal*. 9(2): 397-414. doi:10.2136/vzj2009.0107. (**ISI IF=1.9**)
3. Shaw, S. A.A. Harpold, J.A. Taylor, and M.T. Walter. (2007) Investigating a high-resolution, stream chloride time series from Biscuit Brook catchment, Catskills, NY. *Journal of Hydrology*. 348(3-4): 245-256. doi:10.1016/j.hydrol.2007.10.009 (**ISI IF=3.5**)
2. Harpold, A.A., S. Mostaghimi, P. Vlachos, K. Brannan, and T. Dillaha. (2006) Stream discharge measurement using a large-scale particle image velocimetry (LSPIV) prototype. *Transactions ASABE*. (49)6: 1791-1805. (**ISI IF=1.3**)
1. Wynn, T., S. Mostaghimi, J. Burger, A.A. Harpold, M. Henderson, and L.-A. Henry. (2004) Variation in root density along stream banks. *Journal of Environmental Quality*. 33: 2030-2039. doi:10.2134/jeq2004.2030 (**ISI IF=2.3**)

PUBLICATIONS IN REVIEW

Cooper[#], A.E., Kirchner, J.W., Wolf, S., Lombardozzi, D.L., Sullivan, B., Tyler, S.W. and A.A. Harpold . Snowmelt-driven differences in tree water use and limitations in the Sierra Nevada, USA. <in review at *Agricultural and Forest Meteorology*>

Harpold, A.A., Krogh[@], S., Kohler[$], M., Eckberg[#], D., Greenberg, J., Sterle[$], G., and Broxton, P.D. Increasing the Efficacy of Forest Thinning for Snow Using High-Resolution Modeling: A Proof of Concept in the Lake Tahoe Basin, California, USA. <in review at *Ecohydrology*>

Wen, H., Perdrial, J., Bernal, S., Abbott, B. W., Dupas, R., Godsey, S. E., Harpold, A.A., Rizzo, D., Underwood, K., Adler, T., Hale, R., Sterle, G., and Li, L. Temperature controls production but hydrology controls export of dissolved organic carbon at the catchment scale. <in review at *Hydrology and Earth Systems Science Discussions*> https://doi.org/10.5194/hess-2019-310.

Harpold, A.A., S. Rajagopal, and M. Dettinger. Snow droughts in Western U.S. mountains: frequency, distribution, and proximate causes <in revision for *Water Resources Research*>

Caldwell[*], T.J., S. Chandra, T.P. Albright, A.A. Harpold, T. Dilts, J.A. Greenberg, S. Sadro, and M.D. Dettinger. Drivers and predictions of ice phenology in mountain lakes in the Western United States derived from remote sensing. <in revision for *Limnology and Oceanography*>

Albano[*], C., Dettinger, M., and Harpold, A.A. Patterns and Drivers of Atmospheric River Hydrologic Impact Variability across the Western. <in revision at *Journal of Hydrometerology*>

Pestana[*], S. Lundquist, J., Chickadel, C. Webster, C., Harpold, A.A., Pai, H., Kostadinov, T., and Tyler, S. Bias Correction of Airborne Thermal Infrared Observations Over Forests and Melting Snow. <in revision at *Water Resources Research*>

OTHER PUBLICATIONS

Harpold, A.A., M. Dettinger, and S. Rajagopal. Defining Snow Drought and Why it Matters. (2017) *Mountain Views*. 11(1) [reprinted from EOS 2017 article]

Harpold, A.A., S.W. Lyon, and J.A. Marshall. Using lidar to advance critical zone science. Meeting Notes. *EOS*. October 2014.

Harpold, A.A., J.A. Biederman, and P.D. Brooks. 2013. Where did all that snow go? Compensating vapor losses following forest disturbance in the Rocky Mountains. *Mountain Views*. 7(1).

Harpold, A.A. and T.S. White. Exploring the Critical Zone with LiDAR. 2013. American Geosciences Institute handout for K-12 teachers. Available at criticalzone.org/national/publications

INVITED PRESENTATIONS

"Linking Changing Snow to Streamflow: Rethinking Climate Change's Impacts on Water Resources in the West" UNR, GPHS Colloquium, April 2019.

"Rethinking Snow's Sensitivity to Climate Change" Nevada Water Resources Association Annual Meeting. Reno, NV. February 2019.

"Managing forests with less snow: Combining high-resolution observations and modeling to better predict forest hydrology under change" University of Arizona, Lab of Tree Ring Research. January 2019.

"Great Basin Snowpack Dynamics, Distribution, and Sensitivity to Climate" Great Basin Climate Forum. Desert Research Institute. Reno, NV. December 2018.

"Managing forests with less snow: combining high-resolution observations and modeling to better predict montane forest hydrology" University of California, Berkeley. Geography Colloquium. October 2018.

"Rethinking Snow's Sensitivity to Climate Change" Colorado State University, Natural Resources Ecology Laboratory. Fort Collins, CO. March 2018.

"The [uneven] effects of temperature on snow accumulation and ablation" Interagency Arctic Research Policy Committee. Virtual meeting. March, 2018.

"The Snow You Don't Know: Advances in Snow Hydrology Are Reshaping Our Views Of Hydrological Sensitivity in the Western U.S." University of Vermont Geology Department Seminar Series, Burlington, VT. September 2017.

"Mitigating the Negative Effects of Changing Snowpacks in Nevada", Nevada Water Resources Association Panel Moderator. Reno, NV. February 2017.

"Big Unresolved Questions in Ecohydrology Require Transdisciplinary Mountain Science" MTNCLIM 2016 Early Career Session. Leavenworth, WA. October 2016.

"Variable and Unexpected Hydrological Response to Changing Snowpacks: Determining Future Winner and Losers" Sierra Nevada Research Institute, University of California, Merced. September 2016.

"Mountain Forests: A Critical Resource Under Threat" University of Nevada, VPRI, Earth, Air, and Water Conference

"The future of snow in the Great Basin" Humboldt River Basin Water Authority. July 2016.

"Seeing the forest for the trees: assessing risks to mountain snowpacks by integrating remote sensing, observations and models" Nevada NASA EPSCoR annual meeting. May 2016.

"Airborne Light Detection and Ranging (Lidar): Harnessing Lidar for Science and Natural Resource Management" University of Nevada, VPRI, Big Data Conference

"Paradoxes and Tradeoffs In Hydrological Partitioning To Evapotranspiration and Runoff in Snow-Dominated Systems" UNR DGSE Colloquium. April 2015

"White and Green: The Effects of Environmental Change on Feedbacks Between Snow and Vegetation" UNR Geography Department Colloquium. April 2015

"Water Vapor Fluxes from Snow Covered Landscapes: The Importance of Biotic and Abiotic-Mediated Processes" CUAHSI Cyberseminar, April 2015.

"Better Representations of Snow-Vegetation Interactions Can Improve Water and Forest Management in the 21st Century" NCAR, September 2014

"Community Workshop To Improve LiDAR Applications in the Critical Zone Sciences" Stockholm University, April 2014

"Evaluating the Importance of Snowmelt Infiltration to Soil Water Availability Across Western U.S. Mountain Ecosystems" University of Colorado, Hydrologic Sciences Symposium, April 2014

"Hydrologic response of headwater catchments to forest disturbance in the Rocky Mountains" University of Colorado, INSTAAR Noon Seminar, April 2013

"Snowpack following forest disturbance: Implications for negative feedbacks on water availability" University of Colorado, Geography Dept. Colloquia, October 2012

"Changes in snowpacks, snow melt, and streamflow in the Inter-Mountain West" Colorado School of Mines, Environmental Science Seminar. Golden, CO, October 2011

"Changes in snowpacks, snow melt, and streamflow in the Inter-Mountain West" University of Arizona, Hydrology and Water Resources Colloquium. Tucson, AZ, November 2011

"Using LiDAR to map snow distributions in the Valles Caldera, NM" Executive Meeting of the Board for the Valles Caldera National Preserve, Jemez Springs, NM, May 2011

SELECT CONFERENCE PRESENTATIONS

Harpold, A. Broxton, P., Krogh, S., and Safa, H. Managing Sierra forests for less snow: Improving hydrological prediction by fusing high-resolution observations and models. Western Snow Conference 2019, Reno, NV.

+ Runner up best presentation

Sterle, G. and Harpold, A. "CAMELS-CHEM: Developing a Dataset to Facilitate Hydrochemistry Analysis Across the United States. Western Snow Conference 2019, Reno, NV.

Cooper et al. Montane forest water use under increased episodic and earlier snowmelt. Western Snow Conference 2019, Reno, NV.

+ Best student presentation

Sturtevant et al. Forecasting the Effects of Snow Drought on Streamflow Volumes in the Western U.S. Western Snow Conference 2019, Reno, NV.

+ Third place poster for graduate student

Kohler, M. and Harpold, A. "Atmospheric Humidity Causes Diverging Changes in the Timing and Amount of Snowmelt derived Streamflow Across the West"

+ First place poster for undergraduate student

Rogaczewski, C. and Harpold, A. "Rain on Snow Flooding in the Truckee Meadows, Nevada, USA: A Case Study of Hydrology, Disaster Response, and Mitigating Future Impacts. Western Snow Conference 2019, Reno, NV.

Safa, H. and A. Harpold. Unraveling Controls on Differential Snow Disappearance Under the Forest Canopy versus Open Areas with Observations and Models. Western Snow Conference 2019, Reno, NV.

Katz, L. and A. Harpold, A. "Variation in snow-rain elevations during precipitation events in the eastern Sierra Nevada: Implications for flood forecasting and hydrological modeling

Krogh, S., Broxton, P. and Harpold. A. "An efficient decision support tool to predict the effects of forest thinning on the Sierra Nevada snowpack

Pestana, S. , Harpold, A., American Geophysical Union, Academic, Conference, "Scaling Remotely Sensed Surface Temperatures of Forests and Melting Snow",

Albano, C., Harpold, A., Spatial and Temporal Variability of Atmospheric River Hydrologic Impacts across the Western U.S., AGU Fall Meeting, 2018.

Harpold A. Applying high-resolution modeling and observations of snow-forest interactions to improve water management in the Sierra Nevada. Yosemite Hydroclimate Meeting 2018. Yosemite, CA.

Harpold, A. and P. Broxton. Applying high-resolution modeling and observations of snow-forest interactions to improve water management. MtnClim Meeting 2018. Crested Butte, CO.

Harpold, A. and P. Broxton. Progress using high-resolution snow models in forest management: the Tahoe West Project case study. NASA Airborne Snow Observatory Meeting 2018. Mammoth, CA.

Harpold, A., H. Safa, and P. Broxton. Unraveling controls on snow disappearance timing in forests with observations and models. NASA Airborne Snow Observatory Meeting 2018. Mammoth, CA.

Harpold, A., S. Rajagopal, and M. Dettinger. Snow drought in the western U.S. mountains: proximate causes, regional differences, and sensitivity to a warming climate. Western Snow Conference 2018. Alburqurque, NM

Cooper, A. and A. Harpold. Montane forest water-use under increased episodic and earlier snowmelt. Western Snow Conference 2018. Alburqurque, NM

Kohler, M. and A. Harpold. Potential for Changing Extreme Snowmelt and Rainfall Events in the Mountains of the Western United States. Western Snow Conference 2018. Alburqurque, NM

Kostadinov, T. and A. Harpold. Lidar and DTS Mapping of Fractional Snow Cover in Montane Forests: Implications for Optical Remote Sensing of Seasonal Snow. Western Snow Conference 2018. Alburqurque, NM

Hammond, J. Harpold, A., Kampf, S. Controls on deep drainage beneath the root soil zone in snowmelt-dominated environments. AGU Fall Conference 2017. New Orleans, LA

Kostadinov, T., Harpold, A., Schumer, R. High-resolution LIDAR and ground observations of snow cover in a complex forested terrain in the Sierra Nevada – implications for optical remote sensing of seasonal snow. AGU Fall Conference 2017. New Orleans, LA

Hill, R. Harpold, A., and Calvin, W. Next Generation Snow Cover Mapping: Can Future Hyperspectral Satellite Spectrometer Systems Improve Subpixel Snow-covered Area and Grain Size in the Sierra Nevada? AGU Fall Conference 2017. New Orleans, LA

Harpold, A., Dettinger, M., and Rajagopal, S. Snow drought in western U.S. mountains: proximate causes, regional differences, and implications for streamflow and forests" AGU Fall Conference 2017. New Orleans, LA

Petersky, R. and Harpold, A. Now You See It, Now You Don't: The Influence of Climate and Topography on Snow Seasonality. Western Snow Conference 2017. Boise, ID.

+ Won student best poster "James Church" award

Broxton, P., Harpold, A., van Leeuwen, W., Biederman, J., Demonstrating the Uneven Importance of Fine-Scale Forest Structure on Snow Distributions using High Resolution Modeling. AGU Fall Conference. 2016. San Francisco, CA.

Godsey, S., Tennant, C., Harpold, A., Link, T., Rajagopal, S., Larsen, L., Do existing classification systems capture mountain snowpack heterogeneity? Accounting for spatial variability in a changing environment. AGU Fall Conference. 2016. San Francisco, CA.

Harpold, A., Brooks, P., Earlier and Slower Snowmelt in a Warmer World: Surprising Feedbacks to a Changing Climate. AGU Fall Conference. 2016. San Francisco, CA.

Crews, J., Harpold, A., Rajagopal, S., Schumer, R., Petersky, R., Winchell, T., Humidity affects shifts from snow to rain in the Western U.S.. AGU Fall Conference. 2016. San Francisco, CA.

Molotch, N., Harpold, A., Barnhart, T., Trujillo, E., Hydrologic Response to Changes in the Timing and Rate of Snowmelt: Implications for Water Resource Management in the Western U.S. AGU Fall Conference. 2016. San Francisco, CA.

Rajagopal, S., Harpold, A., Dettinger, M., Improving GPM Precipitation Phase for the Western US. AGU Fall Conference. 2016. San Francisco, CA.

Harpold, A.A. et. Al. Slower Snowmelt in a Warmer World Will Alter Subsurface Hydrology and Basin-Scale Water Budgets. 2016. MTNCLIM conference. Leavenworth, WA.

Harpold, A.A. Interactions Between Hydroclimate and Soil Properties Control the Risk For Altered Hydrologic Partitioning From Changing Snowmelt In the Sierra Nevada. 2016. Yosemite Hydroclimate Conference. Yosemite, CA.

Harpold, A.A. et al., Does Including Soil Moisture Observations Improve Operational Streamflow Forecast in Snow-Dominated Watersheds? 2016. *Western Snow Conference*, Seattle WA.

Harpold et al., Regional Buffering of Changes From Snow To Rain by Humidity Regimes Under Climate Warming in the Western U.S. *Western Snow Conference*, Seattle WA.

Harpold, A.A. Divergent Sensitivity of Soil Water Stress To Changing Snowmelt Regimes in the Western US. AGU Fall Conference. 2015. San Francisco, CA.

Harpold, A. A., P. D. Broxton, Q. Guo, M. J. Barlage, and D. J. Gochis. Utilizing LiDAR Datasets From Experimental Watersheds to Advance Ecohydrological Understanding in Seasonally Snow-Covered Forests. AGU Fall Conference. 2014. San Francisco, CA.

Harpold, A. A. The Sensitivity of Soil Moisture in Western US Mountains to Changes in Snowmelt. AGU Fall Conference. 2014. San Francisco, CA.

Harpold, A.A. and N.P. Molotch. Evaluating The Importance of Snowmelt Infiltration to Soil Water Availability Across Western U.S. Mountain Ecosystems. Global Fair and Workshop on Long-Term Observatories of Mountain Social-Ecological Systems. 2014. Reno, NV.

Harpold, A.A. and N.P. Molotch. Investigating snowmelt infiltration dynamics in the western U.S. using the SNOTEL Network. AGU Fall Conference. 2013. San Francisco, CA.

Harpold, A.A. and N.P. Molotch. Snowmelt infiltration dynamics in seasonally snow-covered areas of the Western U.S. AGU Chapman Conference. 2013. Biosphere 2, AZ.

Harpold, A.A., N.P. Molotch, and D.R. Gochis. Doing Big Science With Big Data: Preliminary Ecohydrologic Investigations at Western CZO Sites. EarthCUBE Meeting. 2013. Newark, DE.

Harpold, A.A., P.D. Brooks, J.N. Perdrial, J.C. McIntosh, T. Meixner, X. Zapata, and J. Chorover. Quantifying variation in solute sources in montane headwater catchments. AGU Fall Conference 2012. San Francisco, CA.

Harpold, A.A., P.D. Brooks, and J.A. Biederman. Snowpack following forest disturbance: Implications for negative feedbacks on water availability. MTNCLIM Conference 2012, Estes Park, CO.

Harpold, A.A., P.D. Brooks and J.A. Biederman. Changes in snow accumulation and ablation following the Las Conchas forest fire, NM. CUASHI Biannual Meeting. 2012. Boulder, CO.

Harpold, A.A., P.D. Brooks, J.A. Biederman, and T. Swetnam. Estimating catchment-scale snowpack variability in complex forested terrain. Valles Caldera National Preserve, NM. AGU Fall Conference 2011. San Francisco, CA.

Harpold, Adrian, P.D. Brooks, J.A. Biederman, A. Somor, P. Troch, D. Gochis, E. Gutmann, H. Barnard, D. Reed, E. Pendall, and B. Ewers. Quantifying the effects of tree die-off from mountain pine beetles on hydrologic partitioning at the catchment scale. Western Water Association: MPB-Water Symposium. 2010. Boulder, CO.

Harpold, A.A., C. Stielstra, S. Rajogopalan, I. Heidebuchel, A. Jardine, and P.D. Brooks. Changes in snowpack volume and snowmelt timing in the Intermountain West. AGU Conference 2010. San Francisco, CA.

Harpold, A.A. Explaining the Spatial Variability in Stream Acid Buffering Chemistry and Aquatic Biota in the Neversink River Watershed, Catskill Mountains, New York State. AGU Conference. 2009. San Francisco, CA.

Harpold, A.A. and T. Steenhuis. Conceptualizing process heterogeneity at multiple spatial scales in the Catskill Mountains, New York State, USA. EGU Conference. 2009. Vienna, Austria.

Harpold, A.A. and T. Steenhuis. Effects of groundwater springs on spatial sources of baseflow in the Catskill Mountains, N.Y. State, USA AGU Conference. 2008. San Francisco, CA.

Harpold, A.A. and T. Steenhuis. Overland flow caused by groundwater springs in the Catskill Mountains, New York, USA. AGU Conference. 2007. San Francisco, CA.

Harpold, A.A., H. Dahlke, and T. Steenhuis. Conceptualizing lateral flowpaths on a hillslope in the Catskill Mountains. New York. AGU Conference. 2006. San Francisco, CA.

Harpold, A., T. Steenhuis, S. Lyon, J. Nieber, M. T. Walter and N. van de Giesen. Generalized SCS Type Equations for Distributed Runoff Generation in Ungauged, Humid Upland Watersheds. Prediction in Ungauged Basins (PUB) Workshop, Corvallis, OR.

Harpold A.A., S. Mostaghimi, P. Vlachos. Stream discharge measurement using a large-scale particle image velocimetry prototype. AGU Conference. 2005. San Francisco, CA.

GRANTS AND CONTRACTS

"Developing a Rain on Snow Monitoring System for the Truckee River", Adrian Harpold (Principal) and Seshadri Rajagopal (co-Principal). NASA Space Grant, $43,150.

"Evaluating Alternative Water Institution Performance in Snow-Dominated Basins: Are Food Production Systems at Risk from Changing Snow Water Availability", Kimberly Rollins (Principal), Adrian Harpold (Co-Principal). USDA, $4.9 million ($202,050 to Harpold).

"From Snow to Flow: Targeted Forest Management Strategies to Increase Streamflow For Ecosystems and People in the Tahoe-Truckee Basin", Naomi Tague (Principal), Harpold, Adrian (Principal), California Wildlife Conservation Board (Proposition 1 funding), University of Nevada, Reno, $708,119 ($283,453 to Harpold)

"Learning From Recent Snow Droughts To Improve Resource Management", USGS Climate Science Center, Harpold, Adrian (Principal), McAfee, Stephanie A (Co-Principal), Rajagopal, Seshadri (Co-Principal), Dettinger, Michael (Co-Principal). $124,142, October 1, 2017-September 30, 2019.

"USFS Tahoe West Shore Project Water Yield Module", Harpold, Adrian (Principal), US Forest Service, Federal, with supplement $139,688. Submitted: July 1, 2016 – December 31, 2020

"USFS Tahoe West Shore Project Water Yield Module - Expanding Hydrological Modeling To Investigate Meadow and Watershed Function" Harpold, Adrian (Principal), US Forest Service, Federal, $55,972. July 20, 2017- – December 31, 2020

"Collaborative Proposal: Combining complex systems tools, process-based modelling and experiments to bridge scales in low temperature geochemistry", Harpold, Adrian (Co-Principal), Perdrial, Julia (Principal), Li, Li (Co-Principal), Rizzo, Donna (Co-Principal), National Science Foundation – Low Temperature Geochemistry, $54,828 to UNR. January 1 2018 – December 31, 2020.

"Identifying Natural Resources Most Sensitive to the 2012-2015 Drought in the Lake Tahoe Basin" Harpold, Adrian (Principal), Weisberg, Peter (Co-Principal), Chandra, Sudeep (Co-Principal), Nevada Division State Lands, State, $64,430. July 1, 2016 – December 31, 2017.

"Lets Talk About Water", Harpold, Adrian (Principal) and students, CUAHSI student grant, $3,532. June 15, 2015 – December 31, 2017.

"Workshop: Developing a Typology of Hydrologic Regime Shifts From Climate-Induced Snowpack Changes in the Western U.S.", Harpold, Adrian (Co-Principal), Tim, Link (Principal), NSF EPSCoR, $11,084. September 1, 2015 – December 31, 2017.

"Workshop: Improving Predictions of Snow-To-Rain Transitions By Synthesizing Observations and Models At Sites Across The Western U.S.", Harpold, Adrian (Principal), Tim, Link (Co-Principal)., NSF EPSCoR, State, $10,606. March 1, 2015 – December 31, 2017.

PROFESSIONAL SERVICE

Member of the Tahoe Science Advisory Council (2019-), steering committee for National Center for Airborne Laser Mapping (NCALM) (2015-), University representative to CUAHSI (2017-), AGU-Ecohydrology Technical Committee member (2018-)

Journal manuscript reviewer for Hydrology and Earth Systems Science, Hydrometeorology, Ecology, Cryosphere, Hydrology, Ecology, Ecological Applications, JGR-Atmospheres, Water Resources Research, Hydrological Processes, PlosOne, Biogeochemistry, Hydrogeology Journal, Hydrobiologia, Vadose Zone Journal, Transactions of ASABE, Arctic and Alpine Research, and International Journal of Climatology, Earth's Future

Proposal reviewer for NASA, NSF, Swiss NSF, DOE Nevada, and EPSCoR

TEACHING AND STUDENT MENTORSHIP

UNR Courses: Principles of Ecohydrology (2015, 2016, 2017, 2018), Small Watershed Hydrology (2016, 2017, 2018)

U. of Arizona courses co-taught: Ecohydrology and Biogeochemstry (2011, 2012) with Paul Brooks

Graduate student mentees (*direct supervisor, #committee member, @ad hoc advisor): L. Katz* (MS-GPHS), G. Sterle* (MS-GPHS), J. Sturtevant* (MS-GPHS), A. Cooper* (MS-GPHS), H. Safa* (PhD-GPHS), J. Weiner* (MS), R. Petersky* (MS-GPHS), P. Longley* (MS-GPHS), T. O'Holloran# (MS-GPHS), J. Jacquet# (MS-GPHS), H. Beeson# (PhD-DGSE), R. Hill# (MS-GPHS), Spencer Whitman# (MS-GPHS), J. Biederman@ (PhD-Arizona), P. Broxton@ (PhD-Arizona)

Undergraduate student mentees: C. Rogozcewski (Foresty, B.S.), G. Sterle (Ecohydrology B.S.), M. Newell (EPSCoR student), M. Kohler (ESPCoR student), S. Weiss (REU student), K. Kauffman (Ecohydrology B.S.), K. Hewson (Ecohydrology B.S.), S. Vazquez (REU student), D. Stielstra (research-tech), B. Stamper (researcher), and Virginia Tech 2004 REU program advisees

STUDENT AWARDS AND GRANTS

Graduate students supervised: B. Gordon (Graduate Dean Fellowship), J. Sturtevant (NASA EPSCoR fellowship, 2018 & Deans Merit Scholarship, 2018), P. Longley (NASA EPSCoR fellowship 2015), and R. Petersky (NASA EPSCoR fellowship 2015)

Undergradatue students supervised: G. Sterle (2019 UROP), C. Rogaczewski (2017, 2018, 2019 Community Reseach Award), M. Kohler (NASA Space Grant fellowship 2017 and 2018, UROP 2017), M. Newell (EPSCoR Scholarship, 2017), K. Hewson - UROP (2016)

Harpold grants as student/post-doc: UNAVCO project support (2012, 2013), NSF IGERT Small Grant - Cornell (2007), The Andrew W. Mellon Research Grant - Cornell (2007), Cornell Graduate Travel Grant (2006, 2007, 2008, 2009), PUB Workshop Student Stipend Award (2006), Virginia Water Resources Grant - Virginia Tech (2004), Virginia Tech Development Program Grant (2003)

Harpold scholarships:: Benjamin F. Brock Scholarship (2003), George C. Vaughan Scholarship (2003), Richard L. Bidwell Engineering Scholarship (2002), John K. Anderson Scholarship (2002), Daniel & Linda Gilbert Scholarship (2001), B. L. Parsons Scholarship (2001), and North Carolina Piedmont Triad Virginia Tech Alumni Association Scholarship (2000)

INTERNATIONAL EXPERIENCE

Traveled to China as part of a scientific exchange regarding Critical Zone science (October 2015)

Served as a consultant to USAID for a project related to improving water management in Mali, July - August 2004