Curriculum Vitae (updated 31 March 2014)

Bruce R. Hargreaves

A. VITAE:

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Education:

Ph.D. 1977 University of California, Berkeley
B.A. 1970 Pomona College

Professional Employment:

1991-present Associate Professor, Dept. of Earth & Environmental Sciences, Lehigh University
1984-91 Associate Professor, Biology Department, Lehigh University
1977-84 Assistant Professor, Biology Department, Lehigh University

B. PUBLICATIONS & CREATIVE ACTIVITIES
REFEREED PUBLICATIONS (I=invited; C=contributed):

Book Chapters

- (I) **Hargreaves, B.R**.,2003. Water Column Optics and Penetration of UVR, pp.59-105 IN: *UV Effects in Aquatic Organisms and Ecosystems*, E.W. Helbling & H. E. Zagarese (eds), Comprehensive Series in Photochemical and Photobiological Sciences, Royal Society of Chemistry, Cambridge, UK, 575 p.

- (I) **Hargreaves, B.R**. 1995. Mysid Crustaceans, p. 59-68 in: L.E. Dove and R.M. Nyman (eds.): *Living Resources of the Delaware Estuary*. The Delaware Estuary Program, 529 pp.

- (C) Herman, S. S., and **B. R. Hargreaves.** 1988. First order estimate of secondary productivity in the Delaware Estuary. Pages 148-156 *in* S. K. Majumdar, E. W. Miller and L. E. Sage, editors. *Ecology and Restoration of the Delaware River Basin*. Penn. Acad. Science. (431 pp.)

- (I) **Hargreaves, B. R**. 1981. Energetics of Crustacean Swimming. Pages 453-490 *in* C. F. Herreid and C. R. Fourtner, editors. *Locomotion and Energetics in Arthropods*. Plenum Press. (546 pp.)

Journal Articles and Refereed Chapters in Conference Proceedings

- (C) 2014, Williamson, C.E., J.A. Brentrup, J. Zhang, W.H. Renwick, **B.R. Hargreaves**, L.B. Knoll, E.P. Overholt, K.C. Rose, Lakes as sensors in the landscape: Optical sentinels of climate change. *Limnol. Oceanogr*. (in press).

- (C) 2014, Marra, J.F., VP.Lance, R.D.Vaillancourt, **B.R.Hargreaves. "**Resolving the ocean's euphotic zone", *Deep-Sea Research I*, 83:45-50.

- (C) 2012, Klug, J.L., D.C. Richardson, H.A. Ewing, **B.R. Hargreaves**, N.R. Samal, D. Vachon, D.C. Pierson, A.M. Lindsey, D.M. O'Donnell, S.W. Effler, K.C. Weathers. "Ecosystem Effects of a Tropical Cyclone on a Network of Lakes in Northeastern North America", *Environ. Sci. Technol*. 46(21): 11693-11701 (DOI: 10.1021/es302063v, link).

- (C) 2012, Wolyniak DiCesare, E.A., **B. R. Hargreaves**, K. L. Jellison. "Biofilms reduce solar disinfection of *Cryptosporidium parvum* oocytes", *Applied and Environmental Microbiology* 78: 4522-4525.
- (C) 2012, Wolyniak DiCesare, E.A., **B. R. Hargreaves**, K. L. Jellison. "Biofilm roughness determines *Cryptosporidium parvum* retention in environmental biofilms", *Applied and Environmental Microbiology*, 78: 4187-4193
- (C) 2011, Lance, V. P., P. G. Strutton, R. D. Vaillancourt, **B. R. Hargreaves**, J.-Z. Zhang, and J. Marra, Primary productivity, new productivity and carbon export during two Southern Ocean Gas Exchange (SO GasEx) tracer experiments, *J. Geophys. Res.*, 117 C00F14, doi:10.1029/2011JC007687. (**link**).
- (C) 2011, Hamme, R. C., N. Cassar, V. P. Lance, R. D. Vaillancourt, M. L. Bender, P. G. Strutton, T. S. Moore, M. D. DeGrandpre, C. L. Sabine, D. T. Ho, and **B. R. Hargreaves**, Dissolved O2/Ar and other methods reveal rapid changes in productivity during a Lagrangian experiment in the Southern Ocean (2012), *J. Geophys. Res.*, 117, C00F12, doi:10.1029/2011JC007046. (link)
- (C) 2011, Ho, D. T., C. L. Sabine, D. Hebert, D. S. Ullman, R. Wanninkhof, R. C. Hamme, P. G. Strutton, B. Hales, J. B. Edson, and **B. R. Hargreaves** (2011), Southern Ocean Gas Exchange Experiment: Setting the Stage, *J. Geophys. Res.*, 116, C00F08, doi:10.1029/2010JC006852. (link).
- (C) 2011, Lee, Z., V. P. Lance, S. Shang, R. Vaillancourt, S. Freeman, B. Lubac, **B. R. Hargreaves**, C. D. Castillo, R. Miller, M. Twardowski, and G. Wei (2011), An assessment of optical properties and primary production derived from remote sensing in the Southern Ocean (SO GasEx), *J. Geophys. Res.*, 116, C00F03, doi:10.1029/2010JC006747. (link)
- (C) 2010, Wolyniak, E.A., **B.R. Hargreaves**, K.L. Jellison. Seasonal Retention and Release of *Cryptosporidium parvum* Oocysts by Environmental Biofilms in the Laboratory, *Appl. Environ. Microbiol* July 2009, 75(13): 4624–4626 .
- (C) 2009, **Hargreaves, B.R**., T. P. McWilliams. Polynomial Trendline Function Flaws in Microsoft Excel, *Comp. Stat. and Data Analysis*, 54: 1190-1196 (http://dx.doi.org/10.1016/j.csda.2009.10.020).
- (C) 2009, Wolyniak, E.A., **B.R. Hargreaves**, K.L. Jellison. Retention and Release of *Cryptosporidium parvum* Oocysts by Experimental Biofilms Composed of a Natural Stream Microbial Community, *Appl. Environ. Microbiol.*, July 2009, p. 4624–4626
- (C) 2007, Belmont, P., **B.R. Hargreaves**, D.P. Morris, C.E. Williamson, Estimating Attenuation of Ultraviolet Radiation in Streams: Field and Laboratory Methods. Photochemistry and Photobiology, 2007, 83: 1–9.
- (I) 2007, **Hargreaves, B.R.**, S. F. Girdner, M. W. Buktenica, R.W.Collier, E. Urbach, G. L. Larson. Ultraviolet Radiation and Bio-optics in Crater Lake, Oregon, *Hydrobiologia* 574:107–140 (http://dx.doi.org/10.1007/s10750-006-0348-0).
- (C) 2007, Larson, G.L., R.L. Hoffman, **B.R. Hargreaves**, R.W. Collier. Predicting Secchi disk depth from average beam attenuation in a deep, ultra-clear lake. *Hydrobiologia* 574:141–148 (http://dx.doi.org/10.1007/s10750-006-0349-z).
- (C) 2006, Galster, J.C., F.J. Pazzaglia, **B.R. Hargreaves**, D.P. Morris, S.C. Peters, R.N. Weisman. Effects of urbanization on watershed hydrology: The scaling of discharge with drainage area, *Geology* 34 (9): 713–716.

- (C) 2006, Cooke, S. L. C. E. Williamson, **B. R. Hargreaves**, D. P. Morris. Beneficial and detrimental interactive effects of dissolved organic matter and ultraviolet radiation on zooplankton in a transparent lake, *Hydrobiologia* 568:15-28.
- (C) 2005, Leech, D.M., C.E. Williamson, R.E. Moeller, **B.R. Hargreaves**. Effects of ultraviolet radiation on the seasonal vertical distribution of zooplankton: a database analysis, Archiv für Hydrobiologie 162(4)445-464.
- (C) 2001, Williamson, C.E., P.J. Neale, G. Grad, H.J. De Lange, and **B.R. Hargreaves**. Beneficial and detrimental effects of UV on aquatic organisms: implications of spectral variation. *Ecological Applications* 11(6): 1843-1857.
- (C) 2001, Osburn, C.L., H.E. Zagarese, D.P. Morris, **B.R. Hargreaves**, W.E. Cravero. Calculations of spectral weighting functions for the solar photobleaching of chromophoric dissolved organic matter in temperate lakes. *Limnol. Oceanogr*. 46(6): 1455-1467.
- (C) 2001, Williamson, C.E., O.G. Olson, S.E. Lott, N.D. Walker, D.R. Engstrom, **B.R. Hargreaves**. Ultraviolet radiation and zooplankton community structure following deglaciation in Glacier Bay, Alaska. *Ecology* 82(6): 1748-1760.
- (C) 1999, Williamson, C.E., **B.R. Hargreaves**, P.S. Orr, and P.A. Lovera. Does UV play a role in changes in predation and zooplankton community structure in acidified lakes? *Limnol. Oceanogr*. 44:774-783.
- (C) 1997, Morris, D.P. and **B.R. Hargreaves.** The role of photochemical degradation of dissolved organic carbon in regulating the UV transparency of three lakes on the Pocono Plateau. *Limnol. Oceanogr.* 42(2):239-249.
- (C) 1996, Ayoub, L.M., **B.R. Hargreaves** and D.P. Morris. UVR attenuation in lakes: Relative contribtution of dissolved and particulate material. *SPIE* 2963:338-343.
- (C) 1995, Morris, D.P., H.E. Zagarese, C.E. Williamson, E.G. Balseiro, **B.R. Hargreaves**, B. Modenutti, R. Moeller and C. Queimalinos. The attenuation of solar UV radiation in lakes and the role of dissolved organic carbon. *Limnol. Oceanogr.* 40:1381-1391.
- (C) 1995, Schulze, P.C., C.E. Williamson and **B.R. Hargreaves**. Evaluation of a remotely operated vehicle (ROV) as a tool for studying the distribution and abundance of zooplankton. *J. Plankton Res*. 17(6):1233-1244.
- (I) 1994, Kirk, J.T.O., **B.R. Hargreaves**, D.P. Morris, R. Coffin, B. David, D. Frederickson, D. Karentz, D. Lean, M. Lesser, S. Madronich, J.H. Morrow, N. Nelson and N. Scully. Measurement of UVB radiation in two freshwater lakes: an instrument intercomparison. *Arch. Hydrobiol. Beih. Ergbn. Limnol.* 43:71-99.
- (C) 1994, Williamson, C.E., H.E. Zagarese, P.C. Schulze and **B.R. Hargreaves**. The impact of short-term exposure to UVB radiation on zooplankton in north temperature lakes. J. *Plankton Res*. 16:205-218.
- (C) 1992, Schulze, P. C., J. R. Strickler, B. I. Bergstrom, M. S. Berman, P. Dohaghay, S. Gallager, J. F. Haney, **B. R. Hargreaves**, U. Kils, G. A. Paffenhofer, S. Richman, H. A. Vanderploeg, W. Welsch, D. Wethey, and J. Yen. Video systems for in situ studies of zooplankton. Pages 1-21 *in* W. G. Sprules, P. C. Schulze and C. E. Williamson, editors. *Advanced techniques for in situ studies of zooplankton abundance, distribution, and behavior.* Vol. 36. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. (140 pp)
- (C) 1992, Sprules, W. G., B. Bergstrom, H. Cyr, **B. R. Hargreaves**, S. S. Kilham, H. J. MacIsaac, K. Matsushita, R. S. Stemberger, and R. Williams. Non-video optical instruments for studying zooplankton distribution and abundance. Pages 45-58 *in* W. G. Sprules, P. C.

Schulze and C. E. Williamson, editors. *Advanced techniques for in situ studies of zooplankton abundance, distribution, and behavior.* Volume 36. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. (140 pp.)

- (I) 1990, **Hargreaves, B. R**., and J. N. Kraeuter. The state of living resources in the Delaware Estuary. Pages 65-108 *in* J. H. Sharp, editor. *Individual Papers from October 1989 Delaware Estuary Program Workshop*. U.S. Environmental Protection Agency. (123 pp.)
- (C) 1985, Smith, R. L., and **B. R. Hargreaves**. Respiratory rate in the mysid Neomysis americana: effects of naphthalene, temperature and other factors. Pages 477-504 *in* F. J. Vernberg, F. P. Thurberg, A. Calabrese and W. B. Vernberg, editors. *Marine Pollution and Physiology: recent advances.* University of South Carolina Press. (545 pp.)
- (C) 1984, Smith, R.L., and **B.R. Hargreaves**. Oxygen consumption in *Neomysis americana* (Crustacea: Mysidacea), and the effects of naphthalene exposure. *Marine Biology* **79**:109-116.
- (C) 1983, Herman, S. S., **B. R. Hargreaves**, R. A. Lutz, L. W. Fritz, and C. E. Epifanio. Zooplankton and Parabenthos, pp. 157-168. Pages 157-168 *in* J. H. Sharp, editor. *The Delaware Estuary: research as background for estuarine management and development*. University of Delaware College of Marine Studies and New Jersey Marine Science Consortium, A report to the Delaware River and Bay Authority. (326 pp.)
- (C) 1983, Smith, R.L., **B.R. Hargreaves**. A simple toxicity apparatus for continuous flow with small volumes: demonstration with mysids and naphthalene. *Bulletin of Environmental Contamination and Toxicology* **30**:406-412.
- (C) 1982, **Hargreaves, B. R**., R. L. Smith, C. Q. Thompson, and S. S. Herman. Toxicity and accumulation of naphthalene in the mysid: Neomysis americana (Smith) and effects of environmental temperature. Paes 391-412 *in* W. B. Vernberg, A. Calabrese, F. P. Thurberg and F. J. Vernberg, editors. *Physiological Mechanisms of Marine Pollutant Toxicity*. Academic Press. (564 pp.)

Other Creative Activities: Patents & Inventions

- 2013: Developed and deployed a submerged instrument, shore interface, and automated datasystem for collecting and interactive web display of real time high frequency (readings at 30 second intervals) temperature, oxygen, and submillimeter-resolution lake level data from Lake Tahoe CA/NV.
- 2011-2013: Automated lake profiling system. BRH proposed concept, explored collaborations, and then collaborated with Colleagues at U. Wisconsin, Madison, and U. Miami, Ohio, and Fondriest Environmental, Inc to refine the design and fabricate the instrument. It is equipped with a YSI sonde and a Turner Designs instrument for measuring geochemical and biological parameters (including the sensors BRH designed/improved listed below). Key features include real-time data communication with base station on shore and Lehigh University, low-power smart winch (0-22m) operable by WiFi web link, bluetooth link between submersible instruments and surface instruments, programmable descent rate to accommodate slow-response pH and oxygen sensors. This was installed for testing in L. Lacawac June-October 2012 and 2013. It is the template for 11 instruments for which funding was requested as part of an NSF Macrosystem Biology proposal resubmission (April 2013 and LTREB proposal January 2014).
- 2011-2012: Instruments for measuring photosynthesis and respiration of algae as function of light and CO2 concentration (50-2200 ppm) via CO2 and O2 flux (adapted LI-COR LI-6400

leaf photosynthesis instrument, designed and built digital air pump and incorporated precision O2 sensor; designed and fabricated a set of air-lift column photobioreactors for algae growth). Made improvements to commercial Multicultivator MC-1000 algae growth system and adapted it for use with LI-6400 to combine metabolism and growth measurements with controlled lighting and temperature. Developed inexpensive CO2 dosing system using pH controller; adapted for CO2 source from compressed CO2 tank and from propane flame.

- 2011: Improved fluorescence sensors for lake and ocean measurements (eliminated turbidity artifact in phycoerythrin sensor; designed and tested microbial sensor responding to protein and amino acid consituents, either dissolved or in cells, using tryptophan aromatic amino acid fluorescence). In collaboration with Turner Designs, Inc.
- 2007: Portable instrument for rapid measurement of spectral reflectance, transmittance, and absorption of suspended particles and thin specimens (intellectual property description in preparation). Funded requests from other scientists for production of this instrument have already been received.
- 2009: Field monitoring of *Cryptosporidium* oocysts using removable biofilm substrate (intellectual property description in preparation with Kristen Jellison and Elizabeth Wolyniak).

C. HONORS & AWARDS

- NASA 2008 group achievement award. Quoting from the award letter: "The Southern Ocean Gas Exchange Experiment (SO GasEx) was selected to received the NASA Group Achievement Award for 2008. It is one of the most prestigious awards a group can receive from NASA, and is presented to selected teams who have distinguished themselves by making outstanding contributions to the NASA mission".

D. RESEARCH FUNDING (TO BRH WITHIN EES) COMPETETIVELY REVIEWED/AWARDED

- 2013 NASA ACE grant proposal **FUNDED**. "Global Algorithm Validation using End-Member Analyses for Baseline ACE Research" with Stanley Hooker. I have my travel expenses covered for field work at Crater Lake OR during Summer 2014. My role is to arrange logistics and local support using my contacts at Crater Lake and to measure spectral absorbance of phytoplankton as well as acquire loan of new instrument to measure CDOM absorbance at Crater Lake.

- 2013 NSF grant proposal (EAR Hydrologic Sciences #NSF 13-531) **PENDING**. "Improved evaporation estimates for inland waters through high frequency heat and water budget measurements and development of modeling algorithms". Submitted 5 December 2013. Total budget $541.8k (brh budget $52k). BRH co-PI role: I developed the following instrumentation plan and data system plan for measuring evaporation rate parameter at high frequency over the large and hydrologically-heterogeneous spatial scale of Lake Tahoe. I provided an array of different methods for estimating evaporation rates to create a cost-effective spatial grid of data. We will use upgraded instruments at 10 existing met-station sites (on shore and on buoys) and will add eddy flux towers at two sites and a second lake level monitoring site to match the one that I installed in May 2013. Eddy flux measurements of heat and water vapor at 10 Hz at two sites will be combined with 10 Hz air T measurements for calculating heat flux by Surface Renewal method and 15-minute average net radiation, RH% plus air and surface T measurements for calculating evaporation by the Bowen Ratio energy budget method. Water budget validation will used high resolution lake level measurements from three sites plus an array of heated precipitation sensors and gaged stream flow. Data will be collected by LNDB software and recorded into a MS SQL Server database with realtime interactive web access (the system I established for one Tahoe site in May 2013).

- 2013 NSF grant proposal (Macrosystem Biology), DECLINED. "Lakes as Sentinels of Climate Change" Proposal Submitted 29 March 2013 to NSF Macrosystems Biology Program. Total budget $6.9M (BRH portion as co-PI, $501k over 5 years).
- 2013 PITA grant proposal for biofilm research, **FUNDED**. "Manufactured Surfaces For In Situ Detection Of *Cryptosporidium* In Water Supplies", Kristen Jellison (PI), Sabrina Jedlicka (coPI), Bruce Hargreaves (coPI), in partnership with Philadelphia Water Department, $25k requested budget.
- 2012 Lacawac NSF grant proposal (#1318747) **FUNDED**. "A regional hub for EON's at Lacawac Sanctuary", $329k request over 3 years starting 1 Aug 2013. Submitted 14 Dec 2012 to DBI (Biological Field Stations & Marine Labs) by Lesley Knoll, PI, Janet Fischer coPI, Bruce Hargreaves coPI, Craig Williamson, coPI, Robert Sanders, coPI. Funding would provide new all-weather laboratory facilities and key instruments by adding a wing to the Lacawac Sanctuary Visitor's Center. This funding will improve both course and research activities at L.U.
- 2012 PAWRRC-Sea Grant proposal for biofilm research, DECLINED. "Manufactured Surfaces For In Situ Detection Of *Cryptosporidium* In Water Supplies", Kristen Jellison (PI), Sabrina Jedlicka (coPI), Bruce Hargreaves (coPI), in partnership with Philadelphia Water Department, $21k requested budget.
- 2012 PITA proposal for algae research: "Field Evaluation Of Algae Pbr At City Of Bethlehem Wastewater Treatment Plant Using Waste Water And Flue Gas Co2 From Digestor Methane", Harun Bilirgen (PI), Bruce Hargreaves (coPI), Don Morris (coPI), in partnership with City of Bethlehem wastewater plant, $33k requested budget.
- 2012 PITA proposal for biofilm research, "Manufactured Surfaces For In Situ Detection Of *Cryptosporidium* In Water Supplies", Kristen Jellison (PI), Sabrina Jedlicka (coPI), Bruce Hargreaves (coPI), in partnership with Philadelphia Water Department, $25k requested budget.
- 2012 NSF proposal (MACROSYSTEM BIOLOGY), DECLINED. "Lakes as Sentinels of Climate Change" Proposal Submitted 17 April 2012 to NSF Macrosystems Biology Program, FastLane Proposal #1241747, Craig Williamson (PI/PD, Miami University), Janet Fischer (CoPI, Franklin & Marshall), **Bruce Hargreaves (CoPI, Lehigh University)**, Lesley Knoll (CoPI, Lacawac Sanctuary and Miami University), Jasmine Saros (CoPI, University of Maine), Wiebke Boeing (CoI, New Mexico State), Evelyn Gaiser (CoI, Florida International; Archbold Director: Hilary Swain), Maria Gonzalez (CoI, Miami University), Weston Nowlin (CoI, Texas State U), John Melack (CoI, UCSB), Bill Renwick (CoI, Miami University), Mike Vanni (CoI, Miami University), Jing Zhang (CoI, Miami University). $6.2M total funding request over 5 years; My role as co-PI (subcontract to L.U. for $419k over 5 years) is the design and coordination/supervision/training for installation and maintenance of new profiling lake monitoring equipment at 11 sites across the country. Funding declined November 2012.
- 2012 DOE proposal via Ben Franklin (**FUNDED** for additional $31,319, March 2012), "Photobioreactor (PBR) for Growing Algae from Municipal Waste Water for CO2 Capture—Add-on Proposal for project DE-EE0001967, DVDA No. 81.129/81.086", with Don Morris and Harun Bilirgen, via Energy Research Center. BRH role has been to lead the supervision of a postdoctoral scientist from Turkey (funded by Turkish govt) and two summer undergraduate interns to conduct growth experiments. BRH also developed algae cultivation methods & designed and fabricated photobioreactor and a bioassay tool for detecting toxic municipal waste, and modified & used LI-6400 system with PBR to measure metabolism for comparison with growth rates.

- 2010 NSF EF proposal (MACROSYSTEM BIOLOGY), "Lakes as Sentinels and Integrators of Climate Change", (proposal DECLINED--NSF 10-555 submitted 16Sep10. $3.75M, C.E. Williamson and J.M. Fischer P.I.'s; co-PI's, B.R. Hargreaves, William Renwick, Jasmine Saros. My role as co-PI (subcontract for $277k over 5 years) is the design and coordination, supervision, & training for installation and maintenance of new lake monitoring equipment at 10 sites across the country (3 lakes not previously instrumented and significant upgrades at 8 other lakes). For the resubmission I have provided a new focus on DOM optics that will be a central feature, and have led the work to develop a automated profiling buoy to replace the fixed-depth sensors that would have been used in the 2010 plan.
- 2010 NASA proposal"Climate Change Impacts on the Crater Lake Foodweb – Crater Lake National Park (proposal DECLINED #10-BIOCLIM10-0116 submitted 20 July 2010), P.I.: G. Schladow, UC Davis; co-PI's: Bruce Hargreaves, Lehigh Univ., Mark Buktenica, National Park Service, Goloka Sahoo, UC Davis, Wendy Trowbridge, U. Nevada, Reno). Total funds budgeted for Lehigh U: $140k over 3 years. My role is major focus on UV-B penetration into Crater Lake and its impact on aquatic ecosystem, with integration of UV-B effects into proposed ecosystem model and evaluation with Aqua MODIS satellite data.
- 2008-2010 NSF DBI grant, **FUNDED**. "Planning Grant for Program and Facility Enhancement at Lacawac Sanctuary". Field station planning grant, $25k, awarded 2008-2010 (BRH is co-PI with Williamson, Sanders, Olsen and PI Janet Fischer). This support enabled planning for a larger field station building grant to facilitate long term research on L. Lacawac, and is consistent with interest within the EES department (see recent review of EES Graduate Studies) in exploring Lacawac as a Long Term Ecological Research site for faculty and students.
- NASA grant, $177,384, **FUNDED** October 2007-September 2009 (no-cost extension through Oct2010), "Optical Properties in the Southern Ocean: In Situ measurements of phytoplankton absorption using the pQFT-TR instrument in support of the Southern Ocean Carbon Program". Hargreaves (PI). Includes full support for one graduate student & summer undergraduates and 6-week research cruise in Southern Ocean (Feb-Apr 2007).
- EPA grant $825,850, 2003-2005, **FUNDED**. "Assessing the interactive effects of landscape, climate, and UV radiation on river ecosystems: Modeling transparency to UV radiation and the response of biota". EPA S.T.A.R. Program. Morris (PI), Hargreaves, Pazzaglia, Weisman, Williamson (co-Pis). The budget contains 3 graduate support packages per year for 3 years.
- IAI-CRN grant, $119k (Lehigh share $36.4k), 1999-2004.**FUNDED**. InterAmerican Institute for Global Change Research, Hargreaves & Morris as co-PI's & Zagarese as PI. Ecogeographic distribution of UV optical properties in lakes f mid-latitude South America (part of "Enhanced ultraviolet-B radiation in natural ecosystems as an added perturbation due to ozone depletion"). Project will explore solar UV effects on aquatic systems longitudinal and elevational gradient in Chile and Argentina, including development of bio-optical climate change indicators for lakes.
- NSF grant, $690,117, 7/96-10/99. **FUNDED.** PI, Morris, co-pi's Hargreaveas, Moeller & Williamson. Causes and consequences of seasonal changes in transparency of lakes to ultraviolet radiation.
- Culpeper Foundation grant, **FUNDED**. $199,938, 1999-2000. PI, Meltzer, Hargreaves, Moses, Morris, co-PI"s. The Lehigh Earth Observatory (LEO) Project: Transforming the

curriculum in Earth and Environmental Sciences (with A.S. Meltzer, D.P. Morris, C.O. Moses. (BRH role: $57k for portable computing platform, Lehigh weather stations and data logger, fluorometer for field/lab).

- NSF grant, $29,500. **FUNDED.** 7/97-10/98 (Morris and Hargreaves). Attenuation of solar radiation in lakes of southern Argentina.
- NSF REU Site grant, **FUNDED**. 2/95-12/97. (Morris PI, Moeller, co-PI). REU Site: Field research and database development in freshwater environmental science. (BRH role: although not officially listed as PI or co-PI, I wrote part of the proposal, planned and carried out the database instruction, supervised interns, and shared the responsibility with Moeller for managing summer logistics).

NONCOMPETETIVE AND INSTITUTIONAL GRANTS

- 2013, **FUNDED**. Lehigh University internal support for an instrumentation seed grant to Steve Peters. The Picarro instrument will measure stable isotopes in carbon and water from environmental samples. I contributed ideas for lake applications to Steve's proposal.
- 2013, **FUNDED**. My ship time and instrument costs were covered by the TERC (Tahoe Environmenal Research Center) while I was on sabbatical leave in California and Nevada January-July 2013.
- 2012, **FUNDED**. summer stipend funding from EES Dept to support undergraduate Stephanie Serritello (poster presented at EI Symposium, Sept. 2012).
- 2012, **FUNDED**. Faculty Innovation Grant Proposal, Kristen Jellison (PI), Bruce Hargreaves CoPI, Sabrina Jedlicka (coPI), $25k, "Manufactured Surfaces for *in situ* Detection of Cryptosporidium in Water Supplies". Research will use Scanning Electron Microscopy and Atomic Force Microscopy to study biofilms known to different in the attachment of the oocysts of this disease-causing organism. The goal is to design a manufactured surface with suitable properties for predictable binding with these oocysts as an improved method for detection and monitoring in streams and managed water systems.
- 2012, **FUNDED**. Faculty Innovation Grant Proposal (Joan Ramage, PI, Bruce Hargreaves Co-PI, with Kate Semmens, PhD candidate), $25k, "Testing Novel Use of Leaf and Soil Sensors for Snow Wetness Monitoring in Extreme, Remote, Arctic Environments", to be submitted April 2012. BRH role has been to develop the instrumentation package and with Kate Semmens to design/conduct lab tests and a trial deployment at L. Lacawac. It is essential to have a well-understood hydrologic context such as BRH has developed at L. Lacawac in order to interpret the hydrologic significance of the signals from capacitance leaf wetness, TDR soil moisture, and ultrasonic snow depth sensors. At L. Lacawac BRH and KAS deployed on the lake and in nearby forest sites for winter 2012 with prototype instruments. The proposed funding will continue work at Lacawac while adding sites in the Yukon basin.
- 2011, **FUNDED.** Visited BIOS for 10 days in July 2011, including a 4-day ocean research cruise, with support from Lehigh alumnus. Two students also were fully funded for travel and tuition and food/lodging at BIOS to take a summer field course.
- 2010, **FUNDED.** Developed proposal for research at BIOS (Bermuda Institute of Oceanographic Sciences). Funded by Lehigh alumnus as part of support for Lehigh students attending summer courses at BIOS. Program expected to continue with annual donor support.
- 2009, **FUNDED.** Faculty Research Grant plus other community funds for proposal with Breena Holland to purchase an instrument to measure airborne particles and conduct a survey of Asthma "hot spots" in the Lehigh Valley.

- 2009-2011, **FUNDED.** National Park Service support, Summer 2007-2011. Ship time and lodging to conduct 2-day optical survey of Crater Lake, Oregon using new instruments provided by BRH. In August 2009 and 2010 I also collaborated with scientists from U.C. Davis and Crater Lake to compare optical measurements on algal fluorescence and particle size distributions in Crater Lake and Lake Tahoe. While I did not visit in 2011 I planned experiments and evaluated results in collaboration with Crater Lake scientists.
- Tahoe Environmental Research Center (TERC) ship time **FUNDED.** In July 2009 and 2010 I collaborated with scientists from U.C. Davis to compare optical measurements on algal fluorescence and particle size distributions in Lake Tahoe with Crater Lake. I have planned a sabbatical leave for 2013 to continue my work on Lake Tahoe and Crater Lake while in residence on the U.C. Davis campus.
- National Park Service & USGS, 8/99-03. Ship support to conduct optical survey of Crater Lake, Oregon and office expenses at Oregon State University, April-July 2002 (host G. Larsen, Oregon State Univ. & USGS).
- Ventures Fund, $2,000, 6/99-6/00: Living Lab ILE (Lennon, Hargreaves, Munley, Sterrett).

E. EDITORIAL BOARD MEMBERSHIP

F. RECENT SCHOLARLY PRESENTATIONS

Organized/chaired sessions

- 5-7 November 2013 GLEON meeting in Bahia Blanca, Argentina. I chaired three sessions on Lakes as Climate Sentinels, facilitating collaboration among an international group of scientists and graduate students. I also worked with two new GLEON members (graduate students) as a faculty mentor.
- 27-28 September 2013, L. Lacawac, Pennsylvania. Co-organizer of Lacawac Ecology Conference. Gave two invited presentations: (1) Automated Lake Sensors & Climate Change: Refining ARTHUR & the use of optical DO sensors; (2) Data availability at Lacawac Sanctuary: GIS, atmospheric and lake.
- 26-27 June 2013, L. Lacawac, Pennsylvania. Co-organizer of Lacawac Ecological Observatory Sensor Workshop. Gave one invited presentation: Optical oxygen sensors: issues and solutions for getting the best data.
- 2 June 2013, U.C. Davis workshop on realtime monitoring in Lake Tahoe with South Korean Lake Research Group. BRH co-organized the workshop and gave one presentation: The Value of High Frequency Real-Time Data for Lake Monitoring.
- 11-12 June 2012, L. Lacawac, Pennsylvania. Co-organizer of Lacawac Ecological Observatory Sensor Workshop.
- 28 Sep 2010, Anchorage, AK Ocean Optics conference, B.R. Hargreaves chaired Bio-optics North" session of oral presentations.
- 8 April 2006, Lehigh Valley Evolution & Ecology Symposium, (co-organizer of the symposium with Murray Itzkowitz; BRH also chaired one session and evaluated student posters for awards)
- 30-31 March 2006. Global Citizenship Best Practices Across the Nation Workshop. (co-organizer with Hannah Stewart-Gambino; BRH also chaired a session: "Strategies for using and encouraging the widespread use of technology")
- March-April 2006, EES Department Foster Hewett Lecture Series (BRH organized four

days days of lectures and social events on the topic of biological evolution with help from a campus-wide committee (March 06: Andy Knoll; April 06: Eugenie Scott. BRH also raised $2,500 from campus sources to help fund the costs and handled all logistics.)

- 12 November 2005, The Future of Scientific Publishing, one-day Symposium co-sponsored by Lehigh Libraries and Lehigh Sigma Xi chapter (BRH was a co-organizer).
- Feb. 2003. UV Optics session at the ASLO Aquatic Sciences Meeting; session chaired by BRH (Salt Lake City, Feb 2003).
- 3 May 2004. As president of the Lehigh chapter of Sigma Xi, BRH organized a dinner & lecture by Dr. Brian Strom, UPENN Medical School ("What are Our Drugs Truly Doing to Our Patients? Lessons from Pharmacoepidemology").
- 28 November 2001. As secretary of the Lehigh chapter of Sigma Xi, BRH organized a "Forum on Bioterrorism: Scientific and Public Health Issues", 7:30-9:00 PM, (invited public health and scientific experts to speak. Featured Dr. Charles Haas, Professor of Environmental Engineering at Drexel Univ, and expert on anthrax decontamination).
- 23 April 2001. As secretary of the Lehigh chapter of Sigma Xi, BRH organized a dinner & lecture by Dr. Ronald Mickens, Clark Atlanta University: "A `Big-Bang' Vaccination Strategy".

Recent Invited Lectures

- 2 June 2013, University of California (Davis) workshop on realtime monitoring in Lake Tahoe with South Korean Lake Research Group. **B.R. Hargreaves**, "The Value of High Frequency Real-Time Data for Lake Monitoring".
- Invited lecture at international conference, "A regional analysis of the physical and biological effects of Tropical Cyclone Irene on lake ecosystems across northeastern United States and eastern Canada". Bruce R. Hargreaves, Jennifer L. Klug, David C. Richardson, Holly A. Ewing, Nihar R. Samal, Dominic Vachon, Don C. Pierson, Amanda E. Lindsey, David O'Donnell, Steven W. Effler and Kathleen C. Weathers, ASLO Aquatic Sciences International Meeting 2012: Voyage of Discovery, Lake Biwa, Shiga Japan, 9 July 2012, Special Session 24 "Lake process monitoring by automated technologies and high-frequency sensors", invited lecture (session organizers Peter A. Stæhr, David Hamilton, Marie-Eve Garneau, and Stefan Bertilsson).
- Invited participant, Joint NERC Environmental Network & Sensor NIS Workshop, Hubbard Brook Experimental Forest, New Hampshire (24-27 Oct 2011).
- Invited participant in NASA AOP Workshop, San Diego, CA, December 2010.
- Invited participant of NSF-funded workshop of Lake Research Public Outreach, Trout Lake Field Station, Wisconsin (October 2009).
- "Advanced Sensors For Lake Research: optimization, adaptation, invention", a presentation to graduate students and advisors during EARS-IGERT workshop at Lacawac Sanctuary, 19 September 2009.
- Lacawac Nature Fest presentation on lake monitoring and climate change, 27 June 2009
- Lacawac Sanctuary Planning Grant Workshop, 30 May to 1 June 2009 (BRH presentations on data management and community outreach on forest and lake management)
- Sigma Xi Research Lecture, Lehigh University (11/08)

- Nature Fest presentation on lake research at Lacawac Sanctuary (6/08)
- Nature Fest presentation on lake research at Lacawac Sanctuary (6/07)
- EES Department Research Lecture, Lehigh University (9/06)
- Lehigh Valley Evolution and Ecology Symposium (4/06)
- Sigma Xi Research Lecture, Lehigh Univ. (3/04)
- Crater Lake Workshop, OSU (2/03)
- Oregon State University research seminar (7/02)
- Sigma Xi Lehigh Chapter research seminar (3/01)
- Lehigh EES Department research seminar (3/00)
- University of Delaware research seminar (3/99)
- Flowing Toward the Future Conference on Delaware River Basin, 11/99
- Lafayette College Geosciences research seminar (2/98)
- Delaware Estuary Program Workshop, Cherry Hill, NJ, 11/98
- Delaware Estuary Program Conference, West Chester, PA,5/97
- Lacawac Sanctuary Public Lecture Series, 7/97
- URISA-96 Conference, NJ, 1/96
- Drexel Univ. research seminar, Phila., 1/96
- Great Decisions seminar, Bethlehem, 3/96 (Global water supply)

Other presentations (recent oral or poster presentations with published abstracts)

- 5-7 November 2013 GLEON meeting in Bahia Blanca, Argentina. Poster with published abstract: **Bruce R. HARGREAVES**, Jennifer A. Brentrup, Craig E. Williamson, Lesley B. Knoll. "Profiling buoy improvements yield new insights on climate change signals in a NE Pennsylvania (USA) lake".
- 5-7 November 2013 GLEON meeting in Bahia Blanca, Argentina. Poster with published abstract: Nihar R. Samal, Klaus D. Jöhnk, Don C. Pierson, Matti Leppäranta, Huaxia Yao, **Bruce R. Hargreaves,** David Hamilton, Rita Adrian, Tim Kratz, Sapna Sharma, James Rusak, Alo Laas, Dominic Vachon, Craig Williamson, "Modeling long-term trends in ice dynamics of seven geographically distributed freshwater lakes"
- 5-7 November 2013 GLEON meeting in Bahia Blanca, Argentina. Poster with published abstract: Jennifer A. BRENTRUP, Craig E. Williamson, **Bruce R. Hargreaves**, Lesley B. Knoll. "Tea or Coffee Anyone? Using high-frequency sensor data to understand differences in DOM optical quality".
- 27-28 September 2013, Lacawac Ecology Conference, L. Lacawac, Pennsylvania. **B.R. Hargreaves** "Automated Lake Sensors & Climate Change: Refining ARTHUR & the use of optical DO sensors"
- 27-28 September 2013, Lacawac Ecology Conference, L. Lacawac, Pennsylvania. **B.R. Hargreaves** "Data availability at Lacawac Sanctuary: GIS, atmospheric and lake data".
- 26-27 June 2013, Lacawac Ecological Observatory Workshop. L. Lacawac, Pennsylvania. **B.R. Hargreaves,** "Optical oxygen sensors: issues and solutions for

getting the best data".

- 17-22 Febrary 2013, ASLO Ocean Sciences Meeting, New Orleans. Robert D. Vaillancourt, Veronica Lance, John F. Marra, **Bruce R. Hargreaves**. "The chemostat hypothesis: a dynamic balance between nitrogen availability and light intensity controls photosynthetic maximum quantum yield in the stably-stratified ocean."
- 5-7 April 2013 Pennsylvania Academy of Sciences (University of Pittsburgh - Bradford campus), Knoll, Lesley B., Jennifer A. Brentrup, Craig E. Williamson, and **Bruce R. Hargreaves**. "Automated Profiling Buoy for Exploring Lakes as Sentinels of Change: ARTHUR at Lake Lacawac".
- 17-22Febrary 2013, ASLO New Orleans. Craig Williamson, Jing Zhang, Jennifer Brentrup, Lesley Knoll, **Bruce R. Hargreaves**, Bill Renwick, Erin Overholt, Kevin Rose. "Lakes as Sensors in the Landscape: Optical Sentinels of Climate Change" in session SS78, Assessing Vulnerability of U.S. Lakes and Reservoirs to Climate Change.
- **B. R. Hargreaves**, J. A. Brentrup, C. E. Williamson, , L. B. Knoll. "Preliminary performance assessment of **ARTHUR** – **A**quatic **R**esource **T**ool for **H**igh-Frequency, **U**nderwater **R**esearch for assessing sentinel responses of lakes to climate change". GLEON-14 international meeting, 15-19 Oct 2012, Mulranny, Co. Mayo, Ireland.
- L. B. Knoll, **B. R. Hargreaves**, J. A. Brentrup, and C. E. Williamson, "*Update on a new GLEON site, Lake Lacawac, PA, US: Data and opportunities"*. GLEON-14 international meeting, 15-19 Oct 2012, Mulranny, Co. Mayo, Ireland.
- J. A. Brentrup, C. E. Williamson, **B. R. Hargreaves**, L. B. Knoll, "**ARTHUR** – **A**quatic **R**esource **T**ool for **H**igh-Frequency **U**nderwater **R**esearch for assessing sentinel responses of lakes to climate change". GLEON-14 international meeting, 15-19 Oct 2012, Mulranny, Co. Mayo, Ireland.
- **B. R. Hargreaves**, J. L. Klug, D. C. Richardson, H. A. Ewing, N. R. Samal, D. Vachon, D. C. Pierson, A. E. Lindsey, D. O'Donnell, S. W. Effler and K. C. Weathers "*A regional analysis of the physical and biological effects of Tropical Cyclone Irene on lake ecosystems across northeastern United States and eastern Canada*", ASLO Aquatic Sciences International Meeting 2012: Voyage of Discovery, Lake Biwa, Shiga Japan, 9 July 2012, Special Session 24 "Lake process monitoring by automated technologies and high-frequency sensors", invited lecture (session organizers Peter A. Stæhr, David Hamilton, Marie-Eve Garneau, and Stefan Bertilsson).
- R.C. Hamme, N. Cassar, M.L. Bender, V.P. Lance, P. G. Strutton, C.L. Sabine, D.T. Ho, and **B R. Hargreaves** 2012. *Rapid changes in dissolved O_2/Ar in a Lagrangian tracer patch reveal a system far from steady-state*, Ocean Sciences (AGU/ASLO), Feb 2012, Salt Lake City, Utah.
- R.D. Vaillancourt, **B.R.Hargreaves**, V. Lance, and J. Marra 2012. *Time scales of photoacclimation in phytoplankton of the Western Antarctic zone.* Ocean Sciences (AGU/ASLO), Feb 2012, Salt Lake City, Utah.
- P. Hsu, S.C. Peters, **B.R. Hargreaves**, D.P. Morris 2011. *Factors influencing mercury photoreactions in fresh waters: an experimental approach manipulating light and DOC.* AGU, December 2011, San Francisco, CA.
- **B.R. Hargreaves**, J. Brentrup, K. Rose, K. Strock, L. Knoll, J. Saros, and C.E. Williamson 2011. *"Lakes as Sentinels of Change: DOC Signals from Terrestrial Watersheds"*. Presented poster as invited participant, Joint NERC Environmental Network & Sensor NIS Workshop, Hubbard Brook Experimental Forest, New Hampshire

(24-27 Oct 2011).

- **B.R. Hargreaves** 2011. "*Lakes as Sentinels of Change: Hydrologic Signals from Terrestrial Watersheds"*. Presented poster as invited participant, Joint NERC Environmental Network & Sensor NIS Workshop, Hubbard Brook Experimental Forest, New Hampshire (24-27 Oct 2011).
- **B.R. Hargreaves** 2011. *"Sentinel Responses to Extreme Weather in a Small Seepage Lake: Changes in hydrologic flux"*. GLEON 13 oral presentation, Mount Sunapee Resort, New Hampshire, 10-15 Oct 2011
- J.A. Brentrup, K.C. Rose, T.H. Leach, C.E. Williamson, J.M. Fischer, J.E. Saros, **B.R. Hargreaves**, R.E. Moeller 2011. "*Sentinel Responses to Extreme Precipitation Events in Lakes: Changes in UV Transparency"*. GLEON 13 poster presentation, Mount Sunapee Resort, New Hampshire, 10-15 Oct 2011
- C. Benko, K. Samuels, **B.R. Hargreaves**, D.P. Morris 2011. *Algae Bioreactor Study and Carbon Sequestration*, Undergrad Research Internship Symposium, 13Sep11.
- **B.R. Hargreaves** 2011. "*Interpreting Lehigh Valley Canal-related History with GIS: combining Sanborn maps and new data"*, 30th Annual Canal History & Technology Symposium, 12 March 2011, Lafayette College, Easton, PA.
- Dangal, Shree R.S., B.S. Felzer, **B.R. Hargreaves**, and Z. Yu 2010, "*Effects of Natural and Anthropogenic Disturbances on Long-term Carbon Storage and Productivity in the U.S. Eastern Temperate Forest*", AGU, December 2010, San Francisco, CA.
- **B.R. Hargreaves** 2010, "*Measured and Modeled Spectral Kd in Crater Lake (OR): an approach to estimate CDOM absorption and constrain current estimates of pure water absorption"*, NASA AOP Workshop , San Diego, CA, December 2010.
- **B.R. Hargreaves** & A. Vaidya 2010, "*Rigorous Calibration of an Improved Filter Pad Method for Phytoplankton Spectral Absorption & Application to SOGASEX*" Ocean Optics 2010 Conference, Anchorage AK, September 2010 (extended abstract and poster).
- **B.R. Hargreaves**, A. Vaidya, & S. Girdner 2010, "*An initial bio-optical comparison of deep ultra-oligotrophic lakes with differing human impact: Lake Tahoe and Crater Lake*", Incline Village, NV, August 2010, GLOW VI, Linking Ecosystem-based Science to Management in the Great Lakes of the World.
- E.A. Wolyniak, **B.R. Hargreaves**, K.L. Jellison 2010, "*Impact of Solar Radiation on the Infectivity of Cryptosporidium parvum Oocysts Associated with Environmental Biofilms"*, Pennsylvania Water Environment Association PENNTEC 2010 Conference, Penn State U., June 2010.
- **B.R. Hargreaves** & Ashma Vaidya 2010, "*Rigorous Calibration of an Improved Filter Pad Method for Phytoplankton Spectral Absorption & Application to SOGASEX*", NASA Ocean Color Workgroup, New Orleans, LA, May 2010.
- **B.R. Hargreaves** 2010, *"Spatial & Temporal Patterns of Phytoplankton & CDOM in Support of Productivity Estimates During the Southern Ocean Gas Exchange Lagrangian Tracer Experiment"*, Ocean Sciences Meeting of ASLO, Portland, OR, February 2010.
- **B.R. Hargreaves**, A. Vaidya, K. A. Wiles, 2009. Optical Measurements Reveal Interplay Between Surface and Bottom Processes Involving Phytoplankton, Organic Carbon, Iron, Light, and Oxygen in two Stratified Mesotrophic Lakes, Fall 2009 AGU Meeting, San Francisco.

- **B.R. Hargreaves**, Ashma Vaidya, and Emily Ain. 2009, NASA Ocean Color Workshop, New York City, 4 May 2009. "Improved accuracy of ground-truth fluorescence data via multiple optical corrections".
- **B.R. Hargreaves, 2008.** Depth-resolved water column spectral absorption of sunlight by phytoplankon during the Southern Ocean Gas Exchange (SOGasEx) Lagrangian tracer experiments. Fall 2008 AGU Meeting, San Francisco.
- **B.R. Hargreaves**, V.P. Lance, R.D. Vaillancourt, J.F, Marra, 2008. An Improved T-R System for Filterpad Measurement of Phytoplankton Spectral Absorption, Ocean Optics 2008, Tuscany, Italy.
- M. Olson, A. Tucker, C.E. Williamson, **B.R. Hargreaves**, 2008. IMPLICATIONS OF CHANGING TEMPERATURE AND ULTRAVIOLET RADIATION REGIMES FOR REPRODUCTIVE SUCCESS OF TEMPERATE FISHES, AGU Chapman Conference (***Lakes and Reservoirs as Sentinels, Integrators, and Regulators of Climate Change***, 8-10 September, 2008, Lake Tahoe)
- E. A. Wolyniak, **B.R. Hargreaves**, K. L. Jellison, 2008. Effects of Environmental Biofilms on the Fate and Transport of *Cryptosporidium parvum*, American Society of Microbiology annual meeting.
- R.D.Vaillancourt, J.F. Marra, V.P. Lance, **B.R. Hargreaves**, 2008. Carbon Dioxide Drawdown During Southern Ocean GasEx: A Preliminary Assessment of the Role of Phytoplankton, NASA CC&E Joint Science Workshop, April 2008, College Park, Maryland.
- **B.R. Hargreaves**, 2008. Phytoplankton spectral absorption in the Southern Ocean: preliminary results from SO-GASEX , NASA CC&E Joint Science Workshop, April 2008, College Park, Maryland.
- **B.R. Hargreaves**, 2007. HIGH FREQUENCY DATA FROM A SMALL-CATCHMENT MID-LATITUDE LAKE & WETLAND STREAM PROVIDE COMPLEMENTARY INFORMATION ABOUT HYDROLOGIC EXCHANGE. International Limnology Society meeting in Montreal, Canada, August 2007.
- R.E. Moeller, D.P. Morris, **B.R. Hargreaves**, C.E. Williamson, 2007. SENSITIVITY OF PHYTOPLANKTON PRODUCTIVITY TO UV RADIATION: Seasonal vs. long-term changes in a lake recovering from acidification. International Limnology Society meeting in Montreal, Canada, August 2007.
- A.J. Luebbe & **B.R. Hargreaves**, 2007. Bog Wetland Hydrologic Response to Storm Runoff: DOC Concentration and Chemical Properties. International Limnology Society meeting in Montreal, Canada, August 2007.
- E.A. Wolyniak, **B.R. Hargreaves** and K.L. Jellison, 2007. INFLUENCE OF DISSOLVED ORGANIC CARBON ON THE VIABILITY AND INFECTIVITY OF *CRYPTOSPORIDIUM*. International Limnology Society meeting in Montreal, Canada, August 2007.
- **B.R. Hargreaves,** 2006. Adaptations of Phytoplankton to Sunlight and Other Optical Properties of Aquatic Ecosystem Particles Detected With a Portable Integrating Sphere Version of QFT. ***Eos*** *Trans. AGU, 87*(52), Fall Meet. Suppl., Abstract B11C-1042
- HAIGHT, Shannon L**., HARGREAVES, Bruce**, and PETERS, Steve, 2006. CHANGES IN THE QUANTITY AND QUALITY OF DOC DURING STORM EVENTS AS A FUNCTION OF LAND COVER. Poster at GSA, 25 October 2006.

- LUEBBE, Andrea Jo, and **HARGREAVES, Bruce R**, 2006. BOG WETLAND HYDROLOGIC RESPONSE TO STORM RUNOFF: DOC CONCENTRATION AND CHEMICAL PROPERTIES. Poster at GSA, 25 October 2006.
- **B.R. Hargreaves**, Moeller, R.E., Sopka, C., Morris, D.P., June 2006. DOC & CDOM DYNAMICS IN SURFACE AND BOTTOM WATERS OF TWO SMALL MID-LATITUDE LAKES INFLUENCE UV TRANSPARENCY. ASLO Aquatic Sciences Meeting, Victoria B.C.
- Moeller, R.E., **Hargreaves, B.R.**, Morris, D.P., Williamson, C.E., June 2006. CORRELATIONS OF RAINFALL, DOC, AND PH TO DECREASING TRENDS OF UV TRANSPARENCY IN TWO SLIGHTLY ACIDIC LAKES, ASLO Aquatic Sciences Meeting, Victoria B.C.
- Morris, D.P., Horacio E. Zagarese, **Hargreaves, B.R.** June 2006. VARIABILITY IN THE RATE OF CDOM PHOTOBLEACHING AND ITS CONTROL. ASLO Aquatic Sciences Meeting, Victoria B.C.
- Kendig, C, A, Porter, J, A, Peters, S, C, **Hargreaves, B, R**, Morris, D, P, June 2006. LABORATORY MANIPULATION OF LAKE WATER CHEMISTRY TO EXAMINE CHANGES IN THE SPECTRAL PROPERTIES OF CHROMOPHORIC DISSOLVED ORGANIC MATTER,ASLO Aquatic Sciences Meeting, Victoria B.C.
- P. Belmont, **B.R. Hargreaves**, and D.P. Morris, June 2006. Empirical model for estimating attenuation of ultraviolet radiation in streams, NABS Annual meeting, Anchorage, Alaska.
- Shannon Haight, **Bruce R. Hargreaves**, Stephen C. Peters, 2006. Stream UV transparency varies with weather and land cover: A paired watershed approach to modeling the concentration and source of dissolved organic carbon and major cations in stream water during stormflow and baseflow. Poster at Lehigh Valley Evolution and Ecology Symposium.
- **Bruce R. Hargreaves**, Donald P. Morris, Frank J. Pazzaglia, Richard N. Weisman, Craig E. Williamson, Stephen C. Peters, Assessing the effects of land use, climate, and UV radiation on river ecosystems in northeastern USA (4 Nov 2005), EPA STAR Project Review (Washington DC).
- **Bruce R. Hargreaves**, Girdner, S.F., Buktenica, M.W., Collier, R.W., Urbach, E., Larson, G. L., 2005. Ultraviolet transparency in Crater Lake, Oregon: decadal cycles during the past century. American Society of Limnology and Oceanography (Aquatic Sciences international meeting, Santiago Spain)
- **Bruce R. Hargreaves**, S. F. Girdner, M. W. Buktenica, R.W.Collier, E. Urbach, G. L. Larson, 2005. Ultraviolet Radiation in Crater Lake Oregon, AAAS Pacific Division Meeting, Ashland OR, June 2005.
- S. C. Peters, **B. R. Hargreaves**, S. L. Haight, 2005. Solute behavior in agricultural vs forested watersheds during storm events: Implications for DOC sources, May 2006 15th Annual Goldschmidt Conference, Moscow Idaho.
- Chris Forstall, Shannon Haight, **Bruce R. Hargreaves**, 2005. USING ASTER DATA TO QUANTIFY RIPARIAN CANOPY AREA FOR A RANGE OF STREAM ORDERS IN EASTERN PENNSYLVANIA, USA, GSA NE Regional Meeting, March 2005
- Shannon Haight, Chris Forstall, **Bruce R. Hargreaves**, 2005. Ground and Satellite Estimates of the Penetration of Ultraviolet and Visible Radiation Through Forest Canopy in Eastern Pennsylvania, USA, GSA NE Regional Meeting, March 2005.

- **Bruce R. Hargreaves**, Stephen C. Peters (scp2@lehigh.edu), Shannon L. Haight, 2005. UV ATTENUATION IN STREAMS: STORM RESPONSE OF GROUNDWATER, RUNOFF, AND CANOPY THROUGHFALL. GSA NE Regional Meeting, March 2005, Saratoga Springs, NY.
- Chris Forstall, Shannon Haight, **Bruce R. Hargreaves**, 2005. USING ASTER DATA TO QUANTIFY RIPARIAN CANOPY AREA FOR A RANGE OF STREAM ORDERS IN EASTERN PENNSYLVANIA, USA. GSA NE Regional Meeting, March 2005, Saratoga Springs, NY.
- Shannon Haight, Chris Forstall, **Bruce R. Hargreaves**, 2005. Ground and Satellite Estimates of the Penetration of Ultraviolet and Visible Radiation Through Forest Canopy in Eastern Pennsylvania, USA. GSA NE Regional Meeting, March 2005, Saratoga Springs, NY.
- D. Morris, **B. Hargreaves**, F. Pazzaglia, R. Weisman, C. Williamson, 2004. ASSESSING THE INTERACTIVE EFFECTS OF LANDSCAPE, CLIMATE, AND UV RADIATION ON RIVER ECOSYSTEMS: MODELING TRANSPARENCY TO UVR AND THE RESPONSE OF BIOTA, EPA STAR Symposium, Washington DC, 16 June04
- Forstall, C.W., **Hargreaves, B. R.** and Nichols, L.M, 2004. QUANTITATIVE MODELING OF DOC TRANSPORT IN THE LEHIGH RIVER WATERSHED, Sigma Xi Regional Symposium, St. Joseph's University, April 2004.
- Nichols, L. M., Forstall, C.W., **Hargreaves, B.R.**, 2004. QUALITATIVE PROPERTIES OF CDOM IN THE LEHIGH RIVER WATERSHED, Sigma Xi Regional Symposium, St. Joseph's University, April 2004.
- **Hargreaves, B.R.**, Forstall, C.W., Nichols, L.M., Morris, D.P., Pazzaglia, F.J., and Williamson, C.E., Weisman, 2004. R.N., LAKE MODEL FOR ULTRAVIOLET ATTENUATION ADAPTED TO STREAMS, International Society of Limnology (SIL), Finland, August 04.
- **Hargreaves, B.R.**, J.H. Morrow, G.L. Larson, S.F. Girdner, R.W. Collier, 2003. Ultraviolet measurements in Crater Lake, Oregon (USA) yield new estimates of UV attenuation and absorption by pure water. ASLO Aquatic Sciences Meeting, February 2003.
- Moeller, R.E., **B.R. Hargreaves**, D.P. Morris, C.E.Williamson, 2003. Seasonal, year-to-year and long term controls of UV attenuation in two mid-latitude lakes of contrasting wetland drainage and dissolved organic carbon content. ASLO Aquatic Sciences Meeting, February 2003.
- **Hargreaves, B.R**., Morris, D.P., Zagarese, H.E., Ferraro, M., Añon Suarez, D., Soto, 2002. D., UV Attenuation & CDOM properties of mid to high latitude southern hemisphere lakes, ASLO meeting, Victoria, June 2002**.**
- Zagarese, H., D. Añón Suárez, V. Rocco, P. Pérez, M. Ferraro, D. Soto, P. de Los Ríos, J. Jaramillo, Arismendi, M. Ruiz, **B. Hargreaves**, D. Morris, 2001. UV attenuation & photolability of dissolved organic matter in temperate lakes of South America, IAI Meeting, Brazil, November, 2001.Williamson, C.E., P.J. Neale, G. Grad, H. J. De Lange, **B. R. Hargreaves**, 2001. Beneficial and detrimental effects of UV radiation: implications of variation in the spectral composition of environmental radiation for aquatic organisms. Aquatic Sciences Meeting of ASLO, Albuquerque NM, 2/01 (abstract).

- **Hargreaves, B.R**., C.L. Osburn, D.P. Morris, R.E. Moeller, 2001. Spectral slope response to solar and biotic processes: Comparison of model with estimates from CDOM absorption and UV attenuation measurements. Aquatic Sciences Meeting of ASLO, Albuquerque NM, 2/01 (abstract).
- Osburn, C.L., D.P. Morris, **B.R. Hargreaves**, H.E. Zagarese, 2001. Modeling the contribution of UV radiation to the photobleaching of CDOM in temperate lakes from North and South America. Aquatic Sciences Meeting of ASLO, Albuquerque NM, 2/01 (abstract).
- Williamson, C.E., P.J. Neale, G. Grad, H. J. De Lange, **B. R. Hargreaves**, 2001. Beneficial and detrimental effects of UV radiation: implications of variation in the spectral composition of environmental radiation for aquatic organisms. Aquatic Sciences Meeting of ASLO, Albuquerque NM, 2/01 (abstract).
- Osburn, C.L., D.P. Morris, **B.R. Hargreaves**, 2000. Spectral dependence of photobleaching of CDOM in lake ecosystems. Pacifichem 2000 Meeting of the International Chemical Congress of Pacific Basin Societies, Hawaii, 12/00 (abstract).
- **Hargreaves, B.R**., D.P. Morris, R.E. Moeller, C.E.Williamson, 2000. Seasonal Variation of Ultraviolet Transparency In Lakes. International meeting of ASLO, Copenhagen, 5/00 (abstract).
- **Hargreaves, B. R**., C. Sopka, D. P. Morris, 2000. Water Column Experiments With CDOM: Seasonal Changes in Photochemical Reactivity and Daily Photobleaching Rates (EOS, ASLO/AGU Ocean Sciences Meeting, San Antonio, 2/2000).
- **Hargreaves, B.R**. and K. Farkas. 1999. Lake evaporation: short-term mass tranfer and energy budget models tested with lake and pan data. Abstract, ASLO 1999 Meeting, Santa Fe.
- Osburn, C.L., D.P. Morris, and **B.R. Hargreaves**, 1999. Modeling the spectral dependence of photobleaching of DOM using absorbance and fluorescence. Abstract, ASLO 1999 Meeting, Santa Fe.
- Farkas, K., B.R. **Hargreaves, B.R**., 1998. Hydrology of two pocono lakes: hourly weather and water level data yield rates of evaporation, runoff, & groundwater exchange. ASLO 1998 Aquatic Sciences Meeting, St. Louis. (abstract).
- **Hargreaves, B.R**. and C.A. Lozupone. 1997. Solar UV bleaching of DOM in lake water: experimental measurements and a model. ASLO 1997 Meeting Abstracts.
- 1996 Moeller, R. E. and **B. R. Hargreaves.** Midsummer resistance of phytoplankton productivity to UV photoinhibition in a clear temperate lake. EOS v.75, abstract for 1996 Ocean Sciences meeting of AGU/ASLO.

G. TEACHING & RESEARCH ADVISING

Courses Taught, (* indicates courses currently taught)

- Arts 1, Choices & Decisions, first year advising course (2007, 2006, 2000).
- *EES 4, Science of Environmental Issues (2-week role, Spring 2009, coordinator Spring 2010, coordinator & instructor Fall 2011)
- *EES 200 Earth History (developed for Spring 2009, co-taught with Joan Ramage 2009,2010; revision for 2011, 2012, and 2014 with Frank Pazzaglia).
- *EES 109, (now EES 89), Geographic Analysis of Our Changing World (4), new course

first offered Spring 2003. Lecture and recitation in computer classroom, with intensive use of computer software (2003-2009; 2005 co-taught with J. Ramage, and every year since then as to sole instructor)

- *EES 396 (now EES 318) advanced version of Geographic Analysis, offered Spring 2012 and Spring 2014.
- EES 31, Environmental and Organismal Biology, Spring 2007 (enrollment 15-25)
- EES 93, 293, Supervised Internship (1-4 credits), typically 0-3 per semester.
- EES 359, EES 380, Case Studies in Ecosystem Ecology (4), Fall semester (enrollment ca. 10)
- *EES 365, Ecophysiology (4) Fall semester of even years (taught first time in fall 2008, adapted for new text and new labs fall 2010, fall 2012, fall 2013). Lecture and laboratory.
- EES 361/BIOS 362, Animal Physiology (4), Spring Semester of odd years (enrollment 35-45). Lecture and recitation.
- EES 384, Lake Ecosystem Field Course (4), summer term, at Lacawac Sanctuary (last taught 2003, 6 students)
- *EES 393, Undergraduate Research (2-4), (enrollment 0-2 per semester).
- *EES 484, Aquatic Ecosystems, renamed Ecosystem Processes in 2008 (3). Graduate core course co-taught with 2-3 others in Fall Semester of even years (enrollment ca. 10; sole instructor 2008, co-taught with Don Morris, 2010, 2012, 2013).
- *EES 487, Advanced topics in Bio-optics (3), Fall Semester, odd years (most recent, Fall 2013, enrollment 3).
- EES 383, Environmental Instruments and Data (4), Fall Semester (enrollment 3-12). Lecture and laboratory.
- EES 384, Lake Ecosystem Field Course (4), Summer (enrollment 7-12; co-taught with others; I was the course leader and organizer).
- Short course on GIS, Spring 2009, to a group of 14 social science faculty and students (organized with Lasker; co-instructor, George Yasko)

Research advising (as primary advisor)

Undergraduate (listing only since 1997)

- Amber Lutey (EES undergraduate research; co-advising 2012-2013 with Don Morris)
- Stephanie Serritello (EES major); summer 2012 research intern, supported by EES grant
- Christopher Benko (ChemEngr) Summer 2011 research intern
- Kadeem Samuels (MechEngr) Summer 2011 research intern
- Christopher Forstall (honors thesis 2004)
- Lisa Nichols (2004)
- Catherine Lozupone (Villanova Univ. honors thesis 1997)
- Elizabeth Blanchet (honors thesis 1999)
- Brian Malnati (summer 1998)

- Christopher Koehl (1998)
- Tom Daniel (summer 1998)
- Kahlil Jones (summer 1997)

Graduate students (as primary advisor; service on committees of other students not listed):

- Catherine Q. Thompson (M.S. 1979; Ph.D. 1984)
- Roy L. Smith (Ph.D. 1984)
- Michal L. Kubik (M.S. 1982, Ph.D. 1989)
- Yin Zhong (M.S. 1996)
- Lore M. Ayoub (M.S. 1997)
- Kathryn L. Farkas (M.S. 1998)
- Cynthia Sopka (M.S. 1999)
- Kelly Maloney (M.S. 2000)
- Christopher Forstall (M.S. 2006)
- Shannon Haight (M.S. 2007)
- Andrea Luebbe (M.S. 2007)
- Elizabeth Wolyniak (Ph.D. December 2010; co-advised with Kristen Jellison)
- Ashma Vaidya (M.S. 2010)
- Kenneth Wiles (M.S. 2010)
- Pin-chin Hsu (M.S. 2012, primary advisor Steve Peters)
- Kathryn Semmens (Ph.D. primary advisor Joan Ramage)

H. SERVICE

University

- STEPS Dashboard Committee, Fall 2009-Spring 2010
- Review panel for ORSP energy research proposals (May 2009)
- Biology Microbiology Search Committee (2009-2010)
- Data Advisory Council (2005-2013)
- Biology Evolution Search Committee (2006-2007)
- LTS Strategic Planning Committee (2006)
- FCC (3 year term prior to 1998)
- FFPOC (1999-2001; chair 2000-2001)
- LEWIS planning committee (2000-2002)
- Software Advisory Council (most recently, 2005-2006)
- STAR Academy weekend presentations to middle school and high school students (annually since the beginning of the program)
- Taylor College (dinners from the inception to 2006)

College

- CAS College Policy (2007-2010, Fall 2013; Chair 2009-2010)
- CAS Representative to RCEAS (2002-2005, 2006-2007)
- CAS Representative to CBE (2005-2006)

Department

- Department liaison to promote and develop summer course opportunities at BIOS (Bermuda Institute of Oceanographic Sciences, funded by a Lehigh alumnus), starting working on this during fall 2010; two summer course participants during summer 2011, and 10-day research for BRH, July 2011.
- Computing Committee chair (ca 1997-2000, 2008-present)
- Ecology White Paper developed (Fall 2007-Fall 2008) submitted to CAS Policy Committee for new ecology & policy degree offered by the Environmental Initiative with support from EES
- Planning for the STEPS building, including DASHBOARD committee
- Undergraduate Instruction Committee (2007-2008, Fall 2013-present)
- 2004 Spring Break Student Trip to South Florida (co-organizer and co-leader)
- Library liaison (2000-present)
- Computer liaison (2000-2005)
- Foster Hewett organizer (Spring 2006)

Professional

- 2013: Collaboration with U.C. Davis scientists Geoff Schladow and Goloka Sahoo for research on Lake Tahoe. Developed and deployed a real-time monitoring instrument and submitted a grant proposal for research on evaporation from the lake.
- 2013: Collaboration with NASA scientist Stan Hooker, first by arranging for him to include Lake Tahoe in a campaign during spring 2013 to optically compare difference ocean and lake sites to test an algorithm for satellite validation and to test a new set of optical instruments developed by Biospherical Instruments, Inc. I also encouraged Stan to include Crater Lake OR in his study and then contributed to a successful NASA proposal to fund the Crater Lake optical work (including my expenses) with my NPS colleague Scott Girdner.
- 2011-2012: Collaboration with Lehigh Energy Research Center scientist (Harun Bilergen) to develop research program on carbon sequestration by algae with growth enhanced by flue gas CO2 and wastewater nutrients (Ben Franklin Partnership).
- 2011-2013: Collaboration with YSI, Inc., Turner Designs, and Fondriest Environmental on profiling buoy design for pending grant proposal.
- 2011-2013: Collaboration with GLEON scientists to design and test a new profiling buoy and improve networked use of real-time data.
- Collaboration with Turner Designs to develop two new fluorescence field sensors in the Cyclops-7 line (deep-UV CDOM and improved Phycoerythrin pigment sensor) with tests in Pocono lakes and Bermuda 2010.
- NASA AOP Workshop, December 2010, San Diego (invited participant, presented

poster)

- Turner Designs Technical Advisory Board (small panel of scientists with expertise relevant to their optical products)
- Sigma Xi (from 2000-2005 as chapter secretary, president elect, president, past president)
- Phi Beta Delta (international scholarship honor society, from 2003-2007 as chapter president-elect, president, and past-president).
- National Canal Museum (board of directors & chair of Facilities Committee until 2013)
- Lacawac Sanctuary (board of directors; chaired of Science & Resource Management Committee until 2013)

Membership in other Professional Organizations

- American Geophysical Union
- American Society of Limnology and Oceanography
- International Limnology Society (SIL)
- American Society for Advancement of Science
- Ecological Society of America
- GLEON: Global Lake Ecological Observatory Network
- NEON: Aquatic Instruments Working Panel

More professional service: Peer review of proposals and journals

- Reviewer of annual reports on lake monitoring for Crater Lake National Park
- *JGR Biogeosciences*
- *Experimental Marine Biology and Ecology*
- *Comprehensive Series in Photochemical and Photobiological Sciences,* Royal Society of Chemistry, Cambridge
- *Arctic*
- *Geophysical Research Letters*
- *Limnology & Oceanography*
- *Limnology & Oceanography Methods*
- *Marine Ecology Progress Series*
- *Chemosphere*
- *Estuarine Coastal & Shelf Science*
- *Hydrobiologia*
- *Journal of Geophysical Research--Biogeosciences*
- *Journal of Photochemistry and Photobiology B: Biology*
- *Journal of Photochemical and Photobiological Sciences*
- *Photochemistry and Photobiology*

- *Water Air and Soil Pollution*
- *Computers and Electronics in Agriculture*
- *STOTEN (Science Technology & Environment)*
- Proposals reviewed: NOAA (Coastal Ocean Program)
- Proposals reviewed: NSF (Biological Oceanography)