

# CHARLES FRANKLIN HARVEY

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## **Integrated fieldwork, laboratory experiments and modeling projects:**

- Arsenic contamination of groundwater (Research sites in Bangladesh, Vietnam and West Bengal).
- Hydrology and ecology of tropical peat forests (Research sites in Borneo).
- Water and chemical exchanges between aquifers and coastal waters (Massachusetts).
- Geologic sequestration of carbon dioxide (Various sites in US).

## **EMPLOYMENT**

### **MIT, Civil and Environmental Engineering, 1998 - present.**

Full Professor (2011), Tenured (2006), Associate Professor (2003).

### **Harvard University, 1996 - 1998.**

Gordon McKay Assistant Professor of Environmental Engineering (tenure track),  
Division of Applied Sciences and Earth and Planetary Science.

### **U. S. Geological Survey, 1988 - 1990.** Menlo Park, CA, Hydrologist.

### **U. S. Geological Survey, 1987 - 1988.** Richmond, VA, Hydrologist.

## **EDUCATION**

### **Stanford, Ph.D., 1996,** Geological and Environmental Sciences. Advisor: Steven Gorelick

National Science Foundation Graduate Fellowship.

Student Appointment, U.S. Geological Survey, Menlo Park.

### **Ohio State University, 1987-88,** School of Medicine.

Completed the first year of medical school (MD) with honors in physiology.

### **Oberlin College, B.A., 1986,** Mathematics.

## **AWARDS/HONORS**

### **Fellow, American Geophysical Union**

### **Fellow, Geological Society of America**

**Geological Society of America, Meinzer Award,** 2014, for advancing the science of Hydrogeology.

**Prince Sultan bin Abdulaziz International Prize for Water,** 2012, Fifth Award Groundwater Prize, for contributions to understanding groundwater contamination.

**M. King Hubbert Award,** 2008, National Groundwater Association (NGWA) prize for science or engineering contributions to the groundwater industry.

**Working-Class Hero,** Miller-McCune Magazine.

**Oliver Lectureship,** Jackson School of Geosciences, University of Texas, 2009.

**Freeman Lecturer,** Boston Society of Civil Engineers and Mass. Inst. of Technology, 2003.

**Science Prize for Online Resources for Education,** American Association of the Advancement of Sciences (AAAS). Member of Harvard-Smithsonian team that produced the environmental science curriculum, *The Habitable Planet*, funded by the Annenberg Foundation, 2010.

**National Science Foundation Career Award,** 1999.

## **ACTIVITIES and SERVICES**

- Elected member of Faculty Policy Committee, MIT.
- Oversight Panel for Critical Zone Observatories, National Science Foundation.
- National Academy of Science committee to review the everglades aquifer storage and recovery program.
- Visiting committee to review the department of Earth Systems Science in the school at Stanford.
- Provided content and film for “Haze, It’s Complicated” a documentary film about peat fires in Southeast Asia. Best Feature, 11th Kuala Lumpur Eco Film Festival, 2018; Award of Excellence, IndiFest 2018 Film Awards
- AAAS expert panel to evaluate and guide the Vermont Experimental Program to Stimulate Competitive Environmental Research (EPSCOR).
- Board of Directors *the Arsenic Foundation* (residing at Harvard University)
- Board of Directors *Sea Change* (a nonprofit organization mediating environmental disputes).
- Panel member for the Department of Energy’s workshop *Basic Research for Geosciences; Facilitating 21st Century Energy Systems*.
- Technical Outreach in Service to Communities (TOSC) appointed by EPA for Cape Cod.
- Organizer of National Science Foundation sponsored workshop on the future of the Ganges-Brahmaputra Delta, held in Bangladesh, 2003.
- Member of National Science Foundation expert panel to assess the effects of the 2004 tsunami on Sri Lanka’s groundwater.
- Associate Editor for *Water Resources Research* and *Hydrogeology*.
- Reviewer for *Nature*, *Science*, *Proceedings of the National Academy of Science*, and many journals.
- Scientific Advisory Committees for Conferences including: Chapman Conference, *Arsenic in Asian Environments*, 2009; *Bringing Groundwater Quality Research to the Watershed Scale*, IAH/AIH, IAHS/AISH, Ontario, 2004; *International Conference on Finite Element Models, Solving Groundwater Problems*, Czech Republic, 2004; *Reactive Transport*, AGU/EGU/HIS *International Workshop on Groundwater Hydrology*, Berkeley, 2002; Gordon Conference on *Flow in Porous Media*, 2002.

## **CONSULTING**

- Founding Scientific Advisor to C12, a private venture for geologic sequestration of carbon dioxide that raised over \$200 million in capital. (Flamed-out when it became clear there would be no serious national program to reduce carbon emissions.)
- Expert Witness for the NAACP, testifying for the clean-up of coal ash basins in the Southeast US.
- Review of US Army’s plan for remediating arsenic contamination at the Fort Devens Superfund site, US Army.
- Government of Singapore (PUB), oversight of the assessment of Singapore’s groundwater resources.
- World Bank, India, development of hydrologic modeling capabilities in India, member of Hydrology Expert Facility.
- Kronick, Moskovitz, Tiedemann and Girard, expert testimony to the California Water Board.
- Industrial Economics, Cambridge Massachusetts, evaluation of proposed EPA regulations for: (i) the paint industry, (ii) fly ash disposal from power plants, and; (iii) Re-use of waste foundry sands.

- Shell Oil, assessment of carbon sequestration strategies in sediments off the coast of New York.
- MacGillifrey Films, technical consultant for IMAX films.
- Kleiner Perkins Caufield & Byers, evaluation of novel water treatment systems.
- Arthur D. Little, groundwater cleanup of Belarusian military bases.

## **PATENTS**

*Characterization of Subsurface CO<sub>2</sub> Sequestration Reservoirs by Air Injection*, U.S. Patent No. 61/241,504, used to test potential sites for CO<sub>2</sub> sequestration.

*High-Resolution Differential Pressure Sensor*, U.S. Patent No. 12/611,454, used to record continuous measurements of groundwater fluxes.

## **PUBLICATIONS SINCE 2000**

- Drainage Canals in Southeast Asian Peatlands Increase Carbon Emissions, 2021, **AGU Advances**, (Nathan C. Dadap, Alison M. Hoyt, Alexander R. Cobb, Doruk Oner, Mateusz Kozinski, Pascal V. Fua, Krishna Rao, Charles F. Harvey, Alexandra G. Konings)
- Evaluation of a field kit for testing arsenic in paddy soil contaminated by irrigation water, 2021, **Geoderma**, (Linden B. Huhmann and Charles F. Harvey and Jason Gross and Anjal Uddin and Imtiaz Choudhury and Kazi M. Ahmed and John M. Duxbury and Benjamin Bostick and Alexander van Geen)
- Carbon storage capacity of tropical peatlands in natural and artificial drainage networks, 2020, **Environmental Research Letters**, (Cobb, Alexander R., Rene Dommain, Fangyi Tan, Hwee En Heng, C.F. Harvey)
- Widespread Subsidence and Carbon Emissions across Southeast Asian Peatlands, 2020, **Nature Geoscience**, (Alison Hoyt, E. Chaussard, and Charles F Harvey)
- Geochemical transformations beneath man-made ponds: Implications for arsenic mobilization in South Asian aquifers. **Geochimica et Cosmochimica Acta**, (M. Stahl and C.F. Harvey)
- Origin of Groundwater Arsenic in a Rural Pleistocene Aquifer in Bangladesh Depressurized by Distal Municipal Pumping, 2020, **Water Resources Research**, (Mozumder, M. R. H., Michael, H. A., Mihajlov, I., Khan, M. R., Knappett, P. S. K., Bostick, B. C., Mailloux, B. J., Ahmed, K. M., Choudhury, I., Koffman, T., Ellis, T., Whaley-Martin, K., San Pedro, R., Slater, G., Stute, M., Schlosser, P., & Geen, A.)
- High-arsenic groundwater in the southwestern Bengal Basin caused by a lithologically controlled deep flow system, 2019, **Geophysical Research Letters**, (Khan, Mahfuzur R, H. A. Michael, B. Nath, B. L. Huhmann, C. F. Harvey, A. Mukherjee, I. Choudhury, M. Chakraborty, M. S. Ullah, K. M. Ahmed, S. L. Goodbred, P. Schlosser, B. C. Bostick, B. J. Mailloux, T. Ellis, A. van Geen)
- Scalar Simulation and Parameterization of Water-Table Dynamics in Tropical Peatlands, 2019. **Water Resources Research**, (Alexander Cobb and Charles F Harvey)
- Quantifying Riverine Recharge Impacts on Redox Conditions and Arsenic Release in Groundwater Aquifers Along the Red River, Vietnam, 2019, **Water Resources Research** (Nghiem, Athena A, Mason O Stahl, Brian J Mailloux, Tran Thi Mai, Pham Thi Trang, Pham Hung Viet, Charles F Harvey, Alexander Van Geen, and Benjamin C Bostick)
- Satellite Soil Moisture Observations Predict Burned Area in Southeast Asian Peatlands, 2019, **Environmental Research Letters**, (Dadap, Nathan C, Alexander R Cobb, Alison M Hoyt, Charles F Harvey, and Alexandra G Konings.).

- From Canals to the Coast: Dissolved Organic Matter and Trace Metal Composition in Rivers Draining Degraded Tropical Peatlands in Indonesia, 2019, **Biogeosciences Discussions**, (Gandois, Laure, Alison M Hoyt, Stéphane Mounier, Gaël Le Roux, Charles Franklin Harvey, Adrien Claustres, Mohammed Nuriman, and Gusti Anshari).
- CO<sub>2</sub> Emissions from an Undrained Tropical Peatland: Interacting Influences of Temperature, Shading and Water Table Depth, 2019, **Climate Change Biology**, (Alison M. Hoyt, Laure Gandois, Jangarun Eri, Fuu Ming Kai, Charles F. Harvey, Alexander R. Cobb)
- Inversion of High-Arsenic Soil for Improved Rice Yield in Bangladesh, 2019, **Environmental Science & Technology**, American Chemical Society. (Huhmann, B., C. F Harvey, Anjal Uddin, I. Choudhury, Kazi Matin Ahmed, J. Duxbury, T. Ellis, and A. Van Geen.)
- Changes in Arsenic Exposure in Araihasar, Bangladesh from 2001 through 2015 Following a Blanket Well Testing and Education Campaign, 2019, **Environment International** 125. Pergamon: 82–89. (Huhmann, Brittany L, Charles F Harvey, Ana Navas-Acien, Joseph Graziano, Faruque Parvez, Yu Chen, Maria Argos, Alauddin Ahmed, A K M Rabiul Hasan, and Habibul Ahsan)
- Tropical Peatland Carbon Storage Linked to Global Latitudinal Trends in Peat Recalcitrance, 2018, **Nature Communications**, (Hodgkins, S.B., C.J. Richardson, R. Dommain, H. Wang, P.H. Glaser, B. Verbeke, B. Winkler, B. Rose, A.R Cobb, V.I. Rich, M. Missilmani, C.F. Harvey).
- Smoke Radiocarbon Measurements from Indonesian Fires Provide Evidence for Burning of Millennia-Aged Peat, 2018, **Proceedings of the National Academy of Sciences**, (Wiggins, E., Czimczik, G.M., Santos, Y. Chen, X. Xu, S.R. Holden, J.T. Randerson, C.F. Harvey, F.M Kai, E.Y. Liya).
- How Temporal Patterns in Rainfall Determine the Geomorphology and Carbon Fluxes of Tropical Peatlands, **Proceedings of the National Academy of Science**, 2017, (Cobb, A. R., A. Hoyt, L. Gandois, J. Eri, R. Dommain, K. A. Salim, Fuu Ming Kai, Nur Haji Su'ut, C. F. Harvey).
- Denial of Long-Term Issues with Agriculture on Tropical Peatlands Will Have Devastating Consequences, 2017, **Global Change Biology**, (Wijedasa, L. S., et al.).
- Field Study of Rice Yield Diminished by Soil Arsenic in Bangladesh.” **Environmental Science and Technology**, 2017, (Huhmann, B. L., C. F. Harvey, Anjal Uddin, I. Choudhury, Kazi M Ahmed, J. M Duxbury, B. C Bostick, and A. Van Geen.)
- Temperature and Burning History Affect Emissions of Greenhouse Gases and Aerosol Particles from Tropical Peatland Fire. (Kuwata, Mikinori, Fuu Ming Kai, Liudongqing Yang, Masayuki Itoh, Haris Gunawan, and Charles F Harvey) **Journal of Geophysical Research-Atmospheres** 122, no. 2 (2017): 1281–92.
- Arsenic Oxyanion Binding to NOM from Dung and Aquaculture Pond Sediments in Bangladesh: Importance of Site-Specific Binding Constants. (Lin, Tiffany Y, S. Hafeznezami, L. Rice, J. Lee, A. Maki, T. Sevilla, M. Stahl, R. Neumann, C.F. Harvey, and IH M. Suffet. “) **Applied Geochemistry** 78 (2017): 234–40.
- Megacity Pumping and Preferential Flow Threaten Groundwater Quality, **Nature Communications**, 2016, (Khan, M. R. et al.).
- Vulnerability of Low-Arsenic Aquifers to Municipal Pumping in Bangladesh, **Journal of Hydrology**, 2016, (Knappett, P. et al.).
- River Bank Geomorphology Controls Groundwater Arsenic Concentrations in Aquifers Adjacent to the Red River, Hanoi Vietnam, **Water Resources Research**, 2016, (Stahl, M. O., Harvey, C. F., Van Geen, A., Sun, J., Thi Kim Trang, P., Mai Lan, V., et al.).
- Review of the Everglades Aquifer Storage and Recovery Regional Study, **National Academies Press**, 2015, (Saiers, J., Harvey, C. F., Hopkins, W., Potter, K.W., Price, R., Pyne, R., Robinson, L.,

Screaton, E., Trussell, R.)

- Forest dynamics and tip-up pools drive pulses of high carbon accumulation rates in a tropical peat dome in Borneo (Southeast Asia), **Biogeochemistry**, 2015, (Dommain R., A. R. Cobb, H. Joosten, P. H. Glaser, A. F.L. Chua, L. Gandois, F. M. Kai, A. Noren, K. Abu Salim, N. S.H. Su'ut, C. F. Harvey).
- Crab Burrows as Conduits for Groundwater-Surface water Exchange in Bangladesh, **Geophysical Research Letters**, 2014, (M. Stahl, M. H. Tarek, D. Yeo, A. B. M. Badruzzaman, C. F. Harvey)
- Detecting Well Casing Leaks in Bangladesh Using a Salt Spiking Method, **Groundwater**, 2014, (M.O. Stahl, J. B. Ong, C.F. Harvey, C. D. Johnson, A.B.M. Badruzzaman, M.H. Tarek, A. van Geen, J. A. Anderson, J. W. Lane).
- Carbon fluxes from an urban tropical grassland, **Environmental Pollution**, 2014, (Ng BJL, Hutyrá LR, Nguyen H, Cobb AR, Kai FM, Harvey C F, Gandois L).
- Origin, composition, and transformation of dissolved organic matter in tropical peatlands, **Geochimica et Cosmochimica Acta**, 2014, (Gandois, L., R. Teisserenc, A. R. Cobb, H. I. Chieng, L. Lim, A. S. Kamariah and C. F. Harvey).
- Retardation of arsenic transport through a Pleistocene aquifer, **Nature**, 2013, (A. van Geen, B. Bostick, P. Trang, V. Lan, N. Mai, P. Manh, P. Viet, K. Radloff, Z. Aziz, J. Mey, M. Stahl, C. F. Harvey, P. Oates, B. Weinman, C. Stengel, F. Frei, R. Kipfer, M. Berg).
- An Off-Grid PV Power System for Meteorological and Eddy Covariance Flux Station in Kranji, Singapore, **Energy Procedia** 33, 2013 (FM Kai, A Cobb, AFL Chua, MH Tee, B Ng, L Gandois, C Harvey)
- Transient Groundwater Dynamics in a Coastal Aquifer: Tides, the Lunar Cycle and the Beach Profile, **Water Resources Research**, 2013, (E. Abarca, H Karam, H. F. Hemond, C. F. Harvey).
- Impact of Deforestation on Solid and Dissolved Organic Matter Characteristics of Tropical Peat Forests: Implications for Carbon Release, **Biogeochemistry**, 2012, (L. Gandois, A. R. Cobb, I. Chieng Hei, L. B. L. Lim, K. Abu Salim, C. F. Harvey).
- Patterns and Variability of Groundwater Flow and Radium Activity at the Coast: A Case Study from Cape Cod, **Marine Chemistry**, 2011, (Michael, H., M. Charette, C. F. Harvey).
- Rice Field Geochemistry and Hydrology: An Explanation for Why Groundwater Irrigated Fields in Bangladesh are Net Sinks of Arsenic from Groundwater, **Environmental Science and Technology**, 2011, (Neumann, R.B., A.P. St. Vincent, L. C. Roberts, A. B. M. Badruzzaman, A. Ali, and C. F. Harvey).
- The Immobility of CO<sub>2</sub> in Marine Sediments Beneath 1500 Meters of Water, **ChemSusChem**, 2010, (House, K.Z., A. Bilgin. C. F. Harvey, D. P. Schrag).
- Anthropogenic Influences on Groundwater Arsenic Concentrations in Bangladesh, **Nature Geoscience**, 2010, (R. B. Neumann, K. N. Ashfaq, A. B. M. Badruzzaman, M. Ashraf Ali, J. K. Shoemaker and C. F. Harvey).
- Marine Electrical Resistivity Imaging of Submarine Ground-Water Discharge: Sensitivity Analysis and Application in Waquoit Bay, Massachusetts, USA, **Hydrogeology**, 2010, (R. D. Henderson, F. D. Day-Lewis, E. Abarca, C. F. Harvey, H. N. Karam, L. Liu, J.W. Lane, Jr.).
- Using Performance Reference Compounds in Polyethylene Passive Samplers to Deduce Sediment Porewater Concentrations for Numerous Target Chemicals, **Environmental Science and Technology**, 2009, (L. Fernandez, C.F. Harvey, P.M. Gschwend).
- The Hydrology of a Groundwater-Irrigated Rice Field in Bangladesh: Seasonal and Daily Mechanisms of Infiltration, **Water Resources Research**, 2009, (R. B. Neumann, M. L. Polizzotto, A. B. M.

- Badruzzaman, M. Ashraf Ali, Z. Zhang, C. F. Harvey).
- Investigation of Aquifer-Estuary Interaction Using Wavelet Analysis of Fiber-Optic Temperature Data, **Geophysical Research Letters**, 2009, (R.D. Henderson, F.D. Day-Lewis, C.F. Harvey)
- Acceptance of M. King Hubbert Award, **Groundwater**, 2009, (C. F. Harvey).
- A Differential Pressure Instrument with Wireless Telemetry for In-Situ Measurement of Fluid Flow across Sediment-Water Boundaries, **Sensors**, 2009, (A. Gardner, H. Karam, A. Mulligan, C.F. Harvey, T. Hammar, and H. F. Hemond).
- The Energy Penalty of Post-Combustion CO<sub>2</sub> Capture and Storage and Implications for Retrofitting the Installed Base, **Energy and Environmental Science**, 2009, (K. House, C. F. Harvey, M. Aziz, D. Schrag).
- Seasonal Water Exchange between Aquifers and the Coastal Ocean, **Nature**, 436, 1145-1149, 2005, (H. Michael, A. Mulligan and C. F. Harvey).
- Environmental Science: Poisoned Waters Traced to Source, **Nature**, 2008, (C. F. Harvey)
- The Effects of Dual-Domain Mass Transfer on the Tritium-Helium-3 Groundwater Dating Method, **Environmental Science and Technology**, 2008, (R. Neumann, E. LaBolle and C. F. Harvey)
- Permanent Carbon Dioxide Storage in Deep-Sea Sediments, **Proceedings of the National Academy of Science**, 2006, (K. House, D. Schrag, C. F. Harvey, K. Lackner).
- A Colorimetric Reaction to Quantify Fluid Mixing, **Experiments in Fluids**, 2006, (P. M. Oates and C. F. Harvey).
- Groundwater Dynamics and Arsenic Contamination in Bangladesh, **Chemical Geology**, 228, 112-136, April 2006, (Harvey, C. F., K. N. Ashfaq, W. Yu, A.B.M. Badruzzaman, M. Ashraf Ali, P. M. Oates, H. A. Michael, R. B. Neumann, R. Beckie, S. Islam and M. F. Ahmed).
- Solid-Phases and Desorption Processes of Arsenic within Bangladesh Sediments, **Chemical Geology**, 228, 97-111, 2006, (M. L. Polizzotto, C. F. Harvey, G. Li, B. Badruzzaman, A. Ali, M. Newville, S. Sutton and S. Fendorf).
- Groundwater Dynamics and Arsenic Mobilization in Bangladesh Assessed Using Noble Gases and Tritium, **Environmental Science and Technology**, 40(1), 2006, (S. Klump, R. Kipfer, O. Cirpka, C. F. Harvey, K. Ashfaq, A.B.M. Badruzzaman, S. Hug and D. Imboden).
- Comment on *Investigating the Macrodistribution Experiment (MADE) site in Columbus, Mississippi, using a three-dimensional inverse flow and transport model*, **Water Resources Research**, 2006, (Molz, F. J., C. Zheng, S. M. Gorelick, and C. F. Harvey).
- Processes Conducive to the Release and Transport of Arsenic into Aquifers of Bangladesh, **Proceedings of the National Academy of Science**, 102(52), 18819-18823, 2005, (M. L. Polizzotto, C. F. Harvey, S. R. Sutton and S. Fendorf).
- Shedding Light on Reactive Microbial Transport in Porous Media: Experimental Visualization and Numerical Modeling of *Pseudomonas Fluorescens* 5RL Bioluminescence, **Contaminant Hydrology**, May 2005, (P. M. Oates, C. Castenson, C. F. Harvey, M. Polz, and P. Culligan).
- Arsenic. Its Biogeochemistry and Transport in Groundwater, in "Biogeochemical Cycles of the Elements", Vol. 43 of *Met. Ions Biol. Syst.*, A. Sigel, H. Sigel, and R. K. O. Sigel, eds., M. Dekker, New York, 2005, (C.F. Harvey, and R. Beckie).
- Groundwater Arsenic Contamination on the Ganges Delta: Biogeochemistry, Hydrology, Human Perturbations, and Human Suffering on a Large Scale, **Comptes-Rendus: Geoscience**, 337(1-2), 2005, (Harvey, C. F., C. Swartz, B. Badruzzaman, N. Keon, W. Yu, A. Ali, J. Jay, R. Beckie, V. Niedan, D. Brabander, P. Oates, K. Ahsfaq, D. Islam, H. Hemond, F. Ahmed).

- Subsurface Geochemistry and Arsenic Mobility in Bangladesh, **Geochemica Acta**, 4539-4557, 2004, (Swartz, C.H., Keon, N.E., Badruzzman, B., Ali, A., Brabander, D, Jay, J., Islam, S., Hemond, H.F., Harvey, C.F.).
- Experimental Visualization of Solute Transport and Mass Transfer Processes in Spatially Heterogeneous Porous Media, **Environmental Science and Technology**, 38(14), 2004, (Zinn, B., C. F. Harvey, L. Meigs, R. Haggerty, W. Peplinski, and C. Freiherr von Schwerin).
- What Controls the Apparent Timescale of Solute Mass Transfer in Aquifers and Soils? A Comparison of Diverse Experimental Results, **Water Resources Research**, 2004, (Haggerty, R., Harvey, C.F., Freiherr von Schwerin, C., Meigs, L.).
- Bromide Transport Before, During, and After Colloid Mobilization in Push-Pull Tests and the Implications for Changes in Aquifer Properties, **Water Resources Research**, 39(10), 2003, (Hellerich, L., Oates, P., Johnson, C., Nikolaidis, N., Harvey, C. F., and Gschwend, P.).
- Arsenic in Groundwater in Bangladesh: A Geostatistical and Epidemiological Framework for Evaluating Health Effects and Potential Remedies, **Water Resources Research**, 39(6), 2003, (Yu, W., Harvey, C. F., and Harvey, C.M.).
- Characterizing Submarine Groundwater Discharge, **Geophysical Research Letters**, 30(6), 1297, 2003, (Michael, H., Lubetsky, J., and Harvey, C. F.).
- When Good Statistical Models of Aquifer Heterogeneity Go Bad: A Comparison of Flow, Dispersion and Mass Transfer in Multigaussian and Connected Conductivity Fields, **Water Resources Research**, 39(3), 1051, 2003, (Zinn, B., and Harvey, C. F.).
- What Does a Slug Test Measure: An Investigation of Instrument Response and the Effects of Heterogeneity, **Water Resources Research**, 38(12), 2003, (Beckie, R., and Harvey, C. F.).
- Arsenic Mobility and Groundwater Extraction in Bangladesh, **Science**, 298, November 2002, (Harvey, C. F., Swartz, C.H., Badruzzman, B., Keon, N.E., Yu. W., Ali, A., Jay, J., Beckie, R., Niedan, V., Brabander, D, Oates, P., Ahsfaq, K., Islam, S., Hemond, H.F., Ahmed, F.).
- Reactive Transport in Porous Media: A Comparison of Model Prediction with Laboratory Visualization, **Environmental Science and Technology**, 36, 2002, (Gramling, C., Harvey, C.F., Meigs, L.).
- Groundwater Flow in the Ganges Delta, **Science**, Technical Comment, May 2002, (Harvey, C. F.).
- Possible Causes of High Arsenic Concentrations in the Well Water of Bangladesh, **Environmental Sciences**, 8(5), 491, 2001, (Harvey, C.F.).
- Evaluation of an Arsenic Sequential Extraction Method for Evaluating Mobility in Sediments, **Environmental Science and Technology**, 35, 2778, 2001, (Keon, N. E., Swartz, C. H., Brabander, D. J., Harvey, C. F., Hemond, H. F.).
- The Global Flux of CO<sub>2</sub> into Groundwater, **Geophysical Research Letters**, 28(2), 2001, (Kessler, T. and Harvey, C.F.).
- Rate-limited Mass Transfer or Macrodispersion: Which Dominates Plume Evolution at the MAcroDispersion Experiment (MADE) Site? **Water Resources Research**, 36(3), 637, March 2000, (Harvey, C.F. and Gorelick, S.M.).

### **SELECTED TALKS**

- The Necromass of Borneo*, Harvard University, Department of Organismal and Evolutionary Biology, 2020.
- Peatland Geomorphology and Carbon Fluxes*, University of Virginia, 2020.

*Physical Controls on Methane Fluxes from Peatlands across the World*, University of British Columbia, 2018.

*What Drives Saline Circulation Cells in Coastal Aquifers? An Energy Balance for Density-Driven Groundwater Systems*, 21<sup>st</sup> Hubbert Quorum, 2018.

*Carbon Dynamics and Hydrologic Processes in Peatlands*, Columbia University, Workshop on the Future of Peatlands, 2015.

*The Mathematical Simplicity of Tropical Peat Swamp Forests*, U. Cal. Berkeley, Earth Sciences Lecture Series, 2014; Stanford University, Woods Institute for the Environment, 2014.

*Tropical Peat Forests: Where the Water Table Creates the Land Surface*, 20<sup>th</sup> Hubbert Quorum, USGS Menlo Park, 2012.

*Tropical Peat Forests*, Presentation to the Minister of Industry and Primary Resources, and the Minister of Forestry of Brunei and the Heart of Borneo Commission, 2012.

Oliver Lectures, University of Texas, 2010:  
*Origins and Solutions of the Arsenic Crisis in Southeast Asia*  
*Coastal Groundwater Dynamics and Biogeochemistry*  
*Geologic Carbon Sequestration: Comparing Terrestrial and Submarine Injection*

Lectures at Marie Curie Symposium (European Union), Corsica, 2010:  
*Reactive Solute Transport: Laboratory Visualization Experiments to Construct and Test Stochastic Theory*  
*Coastal Groundwater Dynamics and Biogeochemistry*  
*Geologic Carbon Sequestration: Comparing Terrestrial and Submarine Injection*

*The Cause of Severe Arsenic Contamination in Bangladesh*, Chapman Conference, *Arsenic in Asian Environments*, 2009.

*Hydrogeology is the Key to Understanding the Arsenic Crisis on the Ganges Delta*, Consortium of Universities for the Advancement of Hydrologic Science, Cyberseminars (on-line live seminar archived at: <http://www.cuahsi.org/sem-archive.html>), 2008.

*Toxics in Groundwater*, Symposium on the Future of Environmental Science, Harvard School of Public Health, 2008.

*Chemical Spreading, Mixing and Reaction in Groundwater*, Gordon Research Conference on Flow in Porous Media, 2006.

*The Hydrology and Biogeochemistry of the Arsenic Crisis in Bangladesh*, Harvard University, Series on the Global Environment, 2006.

*The Arsenic Crisis in Bangladesh*, U.S. Geological Survey, Reston VA, 2006.

*Reactive Transport in Porous Media*, Harvard Geophysics and Rock Mechanics Series, 2006.

*Solute Mixing and Chemical Reaction in Porous Media*, DFG-NSF Workshop on Geochemical Gradients, sponsored by the Deutsche Forschungsgemeinschaft, 2004.

*The Crisis of Arsenic Contamination in Bangladesh*, World Water Symposium, Davis CA, 2004.

*Water Quality and Human Health: Bangladesh as a Case Study*, Public and Private Sector Collaboration in Addressing the UN Millennium Water and Sanitation Goals, American Academy of Arts and Sciences Cambridge, MA, 2003.

*The Arsenic Crisis on the Ganges Delta: Hydrology, Biogeochemistry, Human Perturbations, and Human Suffering on a Large Scale*, Colloque sur l'EAU, French Academy of Science, 2003.

*The Arsenic Crisis in Bangladesh*, ETH (EAWAG), Dübendorf, Switzerland, 2003.

*Solute Transport and Reaction in Groundwater*, Henry Darcy's 200th Birthday: Fundamental Advancements, Observation and Analysis, Geological Society America, Seattle, 2003.

*Direct Visualization of Reactive Transport: Mixing at the Pore-Scale and at the Darcy-Scale*, Conceptual Model Development for Subsurface Reactive Transport Modeling of Inorganic Contaminants,



Radionuclides, and Nutrients, Federal Interagency Steering Committee on Multimedia Environmental Modeling Workshop, Albuquerque, NM, 2003.

## **GRANTS AND FELLOWSHIPS**

- Collaborative Research: Hydrologic Disturbance in Tropical Peatlands: Linking Drainage, Soil Moisture, Flammability, and Carbon Fluxes, **National Science Foundation**, (2019-2022).
- Tools for Managing Tropical Peatlands and Controlling Haze in Southeast Asia, **Singapore National Research Foundation**, (2017–2023).
- Competing Demands and Future Vulnerability of Groundwater: Drinking Water Quality and Food Security in Arsenic-Impacted South and Southeast Asia, Coupled Human Natural Processes (CHN), **National Science Foundation**, (2015-2020).
- Changes in river-aquifer exchange induced by groundwater pumping, and their effect on arsenic contamination in the Red River Delta, Vietnam, **National Science Foundation**, (2015–2018).
- Health Effects and Geochemistry of Arsenic and Manganese, National Institute for Environmental Health, (2012-2017).
- Center for Environmental Modeling and Sensing (CENSAM), Carbon Fluxes in and out of Tropical Forests, **Singapore National Research Foundation**, (2008–2017).
- Water and Carbon Dynamics in Tropical Peat Lands, **National Science Foundation**, (2011–2014).
- Collaborative Research: Enhancing the sustainability of groundwater pumping from low-arsenic aquifers in southern Asia - a case-study in Vietnam south of Hanoi, **National Science Foundation**, (2009–2012).
- Hydrogeology of Kuwait, **Kuwait-MIT Center for Natural Resources and Environment**, (2009).
- Environmental Sensor Networks in Asian Rice Fields, **National Science Foundation**, (2006–2009).
- Saltwater and Freshwater Fluxes through Coastal Aquifers: Multiple Time Scales of Terrestrial and Oceanic Forcing, **National Science Foundation**, (2006–2009).
- CO<sub>2</sub> Sequestration Beneath the Deep-Sea Floor, **Department of Energy**, (2006 –2007).
- Freshwater/Saltwater Interaction at the Coast, **Sea Grant, Woods Hole Oceanographic Institute**, (2006 –2008).
- Groundwater Dynamics and Arsenic Contamination in the Ganges Delta: Irrigated Agriculture, Solute Transport, and Aquifer Flushing, **National Science Foundation**, (2005 –2009).
- Collaborative Research: Mathematical and Experimental Analysis of Transport Phenomena in Highly Heterogeneous Porous Media, **National Science Foundation**, (2003 –2006).
- Rotting Foundations and Groundwater Dynamics Beneath Boston, **City of Boston**, (2003).
- Tracking Arsenic through the Food Chain, **National Institute of Health**, (2002 – 2003).
- Arsenic Contaminated Groundwater in Bangladesh: Characterizing the Source, Mobilization, and Transport, **National Science Foundation**, (2000 - 2003).
- A Sustainable Water Supply System in an Arsenic-Contaminated Asian Environments, **Alliance for Global Sustainability**, (2000 - 2002).
- Revisiting two Basic Processes in Hydrogeology: Solute Transport in Heterogeneous Formations and Chemical Mixing in Porous Media, **National Science Foundation CAREER**, (1999 - 2004).
- Transport Visualization for Studying Mass Transfer and Solute Transport in Permeable Media Upscaling the Effects of Diffusion in Natural Soils and Aquifers, **Department of Energy (Basic Energy Science)**, (2000 - 2003).
- Investigating Contaminant inputs via Submarine Groundwater Discharge to Coastal Waters using Radium Isotopes, **Office of Naval Research** (1999 – 2001).
- A Decision Analysis Framework for Groundwater Remediation, **Environmental Protection Agency (NCERQA)**, (1997 - 2000).

Arsenic Transport through Heterogeneous Sediments, **National Institute of Health**, (1998 - 2000).  
Upscaling Diffusion in Natural Soils and Aquifers, **Department of Energy**, (1998 – 2001).  
Water Resources, **Merck Foundation Grant**, (1996 - 1997).

## **TEACHING and MENTORING**

**Co-Director of Terrascope**, began Fall 2008. Terrascope is an undergraduate learning community at MIT built on a sequence of classes that investigate a different global environmental issue each year.

### **Courses Taught**

- Graduate Level: *Hydrogeology, Hydrology, Stochastic Hydrology, Geostatistics*  
Doctoral Seminars -- *Terrestrial Carbon Fluxes, Reactive Transport, Coastal Hydrology, Mass-Transfer Processes in Groundwater and Soils*
- Undergraduate: *Senior Design Capstone, Introduction to Operations Research, Ecology II: Engineering for Sustainability, Mission 2011: Solving Water Crises, Mission 2012: Fixing the Carbon Cycle; Mission 2013: Solving Food Security; Mission 2015: Strategic Minerals*
- Short Courses and Workshops:  
*Mass Transfer in Groundwater and Soil*, Technical University of Denmark  
*Advanced Groundwater Hydrology*, University of Florence  
*Environmental Challenges for the Bengal Delta*, Dhaka Bangladesh, (NSF funded)  
*Tropical Peat Workshop*, Asian School of the Environment, Nanyang Technical University, Singapore, included four-day field trip to Borneo

### **Doctoral Advisees**

- Completed PhD's: Brittany Huhmann, Neha Mehta, Alison Hoyt (Faculty, Stanford University), Mason Stahl (Faculty, Union College), Hanan Karam (Hydrogeologist, ESI UK), Rebecca Neumann (Faculty, University of Washington), Khandaker Ashfaq (Project Engineer, ARCADIS), Peter Oates (Principle Scientist, QEA), Kurt House (CEO, C12 Energy), Holly Michael (Faculty, Univ. Delaware), Winston Yu (Senior Water Resources Specialist at the World Bank.), Brendan Zinn, Kā'eo Duarte (Vice president of community engagement and resources, Kamehameha Schools)
- Post-Doctoral Researchers: Lauren Somers, Yusuf Jameel, Christopher Swartz, Jenny Jay, Elena Abarca, Alex Cobb, Kurt House, Laure Gandois, Kai Fu-Ming, Yusuf Jameel, Lauren Somers