

The Future of Water

Developing a Sustainable Path Forward

ENVS 6300, Section 660 - Fall 2022

Classroom: TBD

Wednesdays - 5:15pm to 8:00 pm

Water is a fundamental human right. It is necessary for ecosystems to function and for economies to prosper. It is also a \$650 billion global industry growing at 2 to 3x GDP. From Wall Street to rural Sub-Saharan Africa, from technology innovation to aging infrastructure, this course will explore the value of water, the growing water-related risks that societies are confronting, and options for mitigating these risks. We will also explore the water sector, its links to other sectors of the economy, dynamics of the water industry, water investments, and business opportunities.

Water risks are growing, but so are water opportunities, in large part because of existing or looming shortages, decades of underinvestment, population growth, economic growth, rapid industrialization and urbanization, pollution, and climate change. While there is nothing necessarily wrong with using water, its unsustainable use and exploitation can jeopardize any and every aspect of the global economy. There are claims that water is “blue gold” and that “water is the new oil,” and while we do not really like these analogies, we do think water – whether too little, too much, or too dirty – is one of humanity’s next great challenges.

The course:

This course will address the fundamentals of water as a natural resource, as an essential input for economies, and as a business. Water will be critical to global geopolitics and to economic and social development. It will also likely become one of the most influential factors in business decision-making in the future. Furthermore, it is fundamental for leaders across all economic sectors – from pharmaceuticals to financials, energy to agriculture – to understand how to sustainably manage water resources, capitalize on new technologies, mitigate water-related risks, and navigate through complex and dynamic policy and regulation. The course will engage students in high-level discussion and require them to think strategically, challenging them to develop creative and sustainable solutions to some of the greatest challenges facing political and business leaders today. Interactive sessions and projects will provide an introduction to appropriately valuing, investing in, and managing water assets to ensure a sustainable, equitable, and prosperous future.

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Lecture Schedule

Date	Lecture Topic
Aug 31	Class Overview, Global Water Challenge & Introduction to the Global Water Industry <ul style="list-style-type: none"> Be Prepared to Discuss “Drinking Water: A History,” by James Saltzman
Sept 7	Overview of Global Water Risks
Sept 14	The Water Industry, Broken Down – Products, Services, Buyers, Sellers, NGOs and Investors/Financiers
Sept 21	Water Corporate Social Responsibility and Stewardship Initiatives
Sept 28	Advanced Water Treatment Technologies: A Virtual Walk Around the World & Technology Tour with Senior Executives from the World’s Leading Water Company
Oct 5	Money and Water: How Water Projects are Funded and How to Invest in Water
Oct 12	Water, Security, and Conflict <ul style="list-style-type: none"> Part 1: Case Examples from the Developing World Part 2: How We Would Go About Solving these Problems
*Oct 21	Field Trip: A Day in the Life of a Global Water Government Affairs Leader in Washington DC
Oct 26	Management of Water Risk in the Developed World
Nov 2	Global Water Development Agencies, Foundations & NGOs: Helping Those Most at Risk
Nov 9	Water Infrastructure: The Role of Municipal Water Utilities
Nov 16	Global Water Project Development: How Technology, Money & Policy All Come Together in the Form of Real Solutions
Nov 23	Thanksgiving Break – No Class
Nov 30	Group Presentations <ul style="list-style-type: none"> Students to Present Group Projects Followed by Q&A
Dec 7	Group Presentations <ul style="list-style-type: none"> Students to Present Group Projects Followed by Q&A Recap of Semester Careers in Water
Dec 14	Reading Days – No Final Exam

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Lecture Schedule

Class Format Lecture, class discussion focusing on the assigned readings, case studies, group projects and field trip to Washington DC.

Course Grading

- Class participation – 40%
- Paper Analyzing a Problem, its Key Drivers, and possible solutions (7 to 10 pages) – 30%
- Group Project and Presentation – 30%

Class Participation (40%)

Students are expected to have completed assigned readings in advance of class and to come prepared to discuss the relevant topics based on the readings.

Analysis of a Problem (30%)

The course will include one 7 to 10-page paper identifying a serious water-related problem that has clearly manifested itself somewhere around the world (developing or developed country). Describe the problem. What are the major factors driving the problem? Given the risk drivers, what are potential ways of addressing/solving the problem? Could this problem have been foreseen? If so, what were the telltale signs? (e.g., How does Los Angeles ensure that it has a sustainable water future in the face of increasing water scarcity?)

Group Project and Presentation (30%)

Select a distinct challenge or pain point for a company, municipality, agricultural group, or other entity. This can be in water availability, infrastructure provision, regulation, information, knowledge, technology, public-private sector collaboration, investment, community engagement, risk, or other area. Develop a (business) model to best resolve the challenge, addressing issues such as funding, management, risk, policy, regulation equity, sustainability, etc. Account for direct and indirect risks, costs and environmental impacts. Address the sustainability of the solution as well as areas of potential challenge or conflict. Speak to how you would turn your proposed model into a real-life solution – taking it from the classroom to the boardroom or government agency.

We will discuss the project, resources and grading criteria in greater detail in the first session.

Office Hours Lecturers will be available for virtual office hours by appointment

Diversity Statement: *The Earth and Environmental Science Department embraces human diversity and intends equity and inclusion in our community and our classrooms. We expect instructors, staff, and students to respect our diversity. We encourage you to contact our Climate, Diversity, Equity and Inclusion (CDEI) Committee [EES-CDEIC@groups.sas.upenn.edu](mailto:CDEIC@groups.sas.upenn.edu) if you need **support or have suggestions for how our CDEI efforts in EES can improve.***

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Reading Materials

Readings for Each Class

Specific readings will be provided to students in pdf form one week in advance of each class.

Required Reading for First Class

- **Drinking Water: A History**, James Saltzman
 - In addition to providing discussion material for our August 31 class, the book will provide context for our class throughout the semester.

Additional Resources to be Read on an As-Interested Basis

- **Unquenchable: America's Water Crisis and What To Do About It**, Robert Glennon
- **The Ripple Effect: The Fate of Fresh Water in the Twenty-First Century**, Alex Prud'homme
- **The Future of Water**, Steve Maxwell
- **Blue Revolution: Unmaking America's Water Crisis**, Cynthia Barnett
- **The Big Thirst: The Secret Life and Turbulent Future of Water**, Charles Fishman
- **The World's Water Volume 7: The Biennial Report on Freshwater Resources**, Peter H. Gleick
- **The Atlas of Water, Second Edition: Mapping the World's Most Critical Resource**, Maggie Black and Jannet King
- **Water Resource Economics: The Analysis of Scarcity, Policies, and Projects**, Ronald C. Griffin
- **Determining the Economic Value of Water: Concepts and Methods**, Robert A. Young
- **Cadillac Desert: The American West and Its Disappearing Water, Revised Edition**, Marc Reisner
- **Water: The Epic Struggle for Wealth, Power, and Civilization**, Steven Solomon
- **The Great Thirst: Californians and Water-A History, Revised Edition**, Norris Hundley
- **Bottled and Sold: The Story Behind Our Obsession with Bottled Water**, Peter H. Gleick
- **The Nile River Basin: Water, Agriculture, Governance and Livelihoods**, Seleshi Bekele Awulachew, Vladimir Smahktin, David Molden and Don Peden
- **Water Stress is Helping Drive Conflict and Migration – How Should the Global Community Respond?**, Charles Iceland
- **Addressing Water Scarcity Through Recycling & Reuse: A Menu for Policy Makers**, Jon Freedman & Colin Enssle

The Future of Water Instructor Biographies

Jon Freedman, Senior Vice President, Global Government Affairs at SUEZ Water Technologies & Solutions



Jon Freedman is based in Washington, DC, where he leads global government affairs for SUEZ Water Technologies & Solutions, which has operations in more than 100 countries. Previously, he led global government affairs & partnerships for GE's water and nuclear business units. In addition, he led the creation of GE's global environmental sustainability initiative (Ecomagination). He also helped GE create a global water business by leading the acquisition of an NYSE-listed water company.

Jon serves on the advisory board of The Wharton School's Institute for Global Environmental Leadership. He also serves on the board of directors of the WaterReuse Association. Jon has authored numerous articles and speaks frequently on water issues globally.

Jon holds a bachelor's degree from the University of Virginia, a law degree from William & Mary, and an MBA in finance from The Wharton School of the University of Pennsylvania.

Francesca McCann, Business Development Director, infraManagement Group (a Black & Veatch Company)

Francesca McCann has been at the forefront of water strategy, project development and investment for nearly two decades. She is the Business Development Director for infraManagement Group (iMG), a Black & Veatch company. She served as the CEO of Abengoa Water USA, where she led the team to the successful contracting of the largest water supply public-private partnership (PPP), a \$3.4 billion project. In 2008, she founded Global Water Strategies, an investment, strategy and policy advisory firm. Prior to founding Global Water Strategies, Francesca covered the water sector for Wall Street.



Francesca has been featured in print and on television including the New York Times, Business Week, Barron's, Bloomberg and MSNBC. She frequently speaks at prominent water conferences in the U.S. and abroad. She has also been published in numerous industry journals and is regularly cited in trade publications.

Francesca speaks four languages and has lived in Asia, Latin America, and Europe. She holds a BA in International Political-Economy from Colorado College and an MBA from the UCLA Anderson School.

Charles Iceland – Global Director, Water (Interim) at World Resources Institute



Charles Iceland is Global Director, Water (Interim) with WRI's Food, Forests, Water, and the Ocean Program. In addition to overseeing the Global Water Team, Charles is implementing the [Water, Peace, and Security Partnership](#) with several European and American partner organizations. As part of this project, he and his team have developed a machine learning-based conflict prediction tool that leverages information on environmental, political, economic, social, and demographic conditions worldwide. The partnership was awarded the 2020 Luxembourg Peace Prize for Outstanding Environmental Peace.

He previously directed the [Aqueduct](#) project at WRI. With the original Aqueduct Team, he developed the concept for the Aqueduct Water Risk Atlas, which maps a variety of global water risks and has become the premier online tool for global water risk assessment and prioritization. He also developed the concepts for Aqueduct Floods and Aqueduct Food. He is currently working on a new project – Global Water Watch – which will track global water availability in near real-time.

Charles previously partnered with several major multinational corporations, including Mondi Group, Rio Tinto, Akzo Nobel, and BC Hydro, to develop, road test, and apply an innovative methodology for assessing corporate risks and opportunities stemming from ecosystem change. Prior to that, he worked at the World Environment Center, where he developed innovative supply chain environmental management pilot programs for Alcoa, Johnson & Johnson, Dow Chemical, and General Motors. Charles has worked at the Office of the United States Trade Representative, the United States House of Representatives, and the Peterson Institute for International Economics. He also worked in the banking and finance sector for several years and is a Chartered Financial Analyst (CFA). Charles earned his undergraduate degree from Yale University and a master's degree in international affairs from Columbia University.