



WATER IN ARCHITECTURE, LANDSCAPE + URBANISM

Water is one of the most evocative and challenging elements in environmental design. This one-day workshop draws together SA+P colleagues working on various aspects of water to:

1. Exchange ideas on current water projects
2. Identify collaborative studio and research projects
3. Develop a water research and teaching agenda at MIT

Concept Paper for Discussion: *Water: The Scaling and Diffusion of Solutions*

Attached is a concept paper on *scale* and *diffusion* in water science, planning, and design to stimulate our workshop discussion.¹ It puts forward the following arguments:

1. **Scaling: From Pool to Planet.**
Water problems must be addressed at a continuous range of scales from global modeling to site design. And site design must “scale up” to address regional and international water problems. At present, there is great potential but little evidence to support these claims.
2. **Diffusion: Design in Mumbai matters for Mazdar and Massachusetts (and vice versa).**
SA+P launches new urban water studies and studios every semester in almost every region of the world. How can these projects build on one another? And how can our students develop expertise in water planning and design?

We will address these cross-cutting theses through a series of conversations at the three scales outlined below (site, city, and region).

SCHEDULE: SATURDAY, APRIL 18, 2009, MIT 9-250

10:00 Welcome and aims

Jim Wescoat (AKPIA)

10:05 Opening comments

Adele Santos, Dean, School of Architecture + Planning

Yung Ho Chang, Head, Department of Architecture

Philip Houry, Associate Provost, International Programs

Dara Entekhabi, CEE and Director, Parsons Lab

Larry Susskind, DUSP and EPP-MUSIC

¹ Entekhabi and Wescoat, Draft 10 April 2009.

10:30 Water in Architecture and Landscape Site Design

Discussion Convenors:²

Eran Ben-Joseph (DUSP; sustainable site design)
Rahul Mehrotra (ARCH; architectural design in India)
Susan Murcott (CEE; Household water systems in Africa)
Carlo Ratti (ARCH; Digital Water Pavilion in Spain)

Programmatic Questions:

Water in the undergraduate curricula
Water in the MArch and MCP curricula
Water in the SMArchS curriculum

11:30 Working Lunch
Comparative Coastal and Urban Waterfront Design

Discussion Convenors:

Julian Beinart (ARCH; coastal urbanism)
Dennis Frenchman (DUSP; ports and waterfronts)
Rahul Mehrotra (ARCH; Bombay waterfront)
Nasser Rabbat (AKPIA; Qatar and Gulf)
Alexander D'Hooghe (ARCH; northern Europe [virtual contribution])

Programmatic Questions:

Water in the SMArchS curriculum
Water in the DUSP MS curriculum

1:00 Watershed, Wetland, and River Channel Design -
from Regional to Local Scales

Discussion Convenors:

Alan Berger (DUSP; wetlands and reclamation)
Dara Entekhabi (CEE; water-land cover-climate interactions)
Anne Whiston Spirn (ARCH/DUSP; irrigation and drainage)
Jim Wescoat (AKPIA; water heritage conservation)

Programmatic Questions:

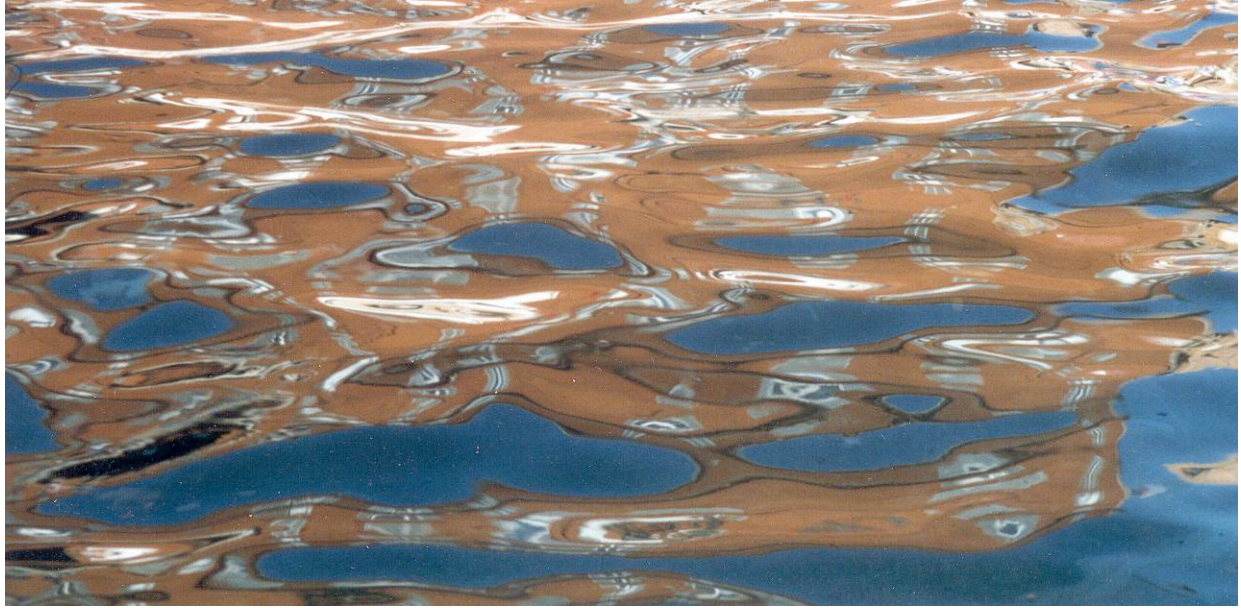
Water in the L+U program
Water in the AKPIA program

2:00 Summary
Architecture, Landscape + Urbanism Water Priorities on:

- Scaling of solutions – focal scales and linkages
- Diffusion of innovations – regional and comparative priorities
- Program development – studios and curriculum

Informal reception at the Wescoats (33 Market St, Cambridge [walk over])

² Convenors will briefly kick off the discussion with questions, ideas, and experience for group discussion.



WATER: THE SCALING AND DIFFUSION OF SOLUTIONS

“Just as the thirsty seek the water, so too does water seek the thirsty” (Rumi)

Water is one of the most fascinating substances in the universe from subatomic to cosmic scales, as well as at every scale of human interest and inquiry in between. New physical research on the water molecule appears annually in leading scientific journals—while global environmental change research focuses on water resources impacts and adaptations. Water-related flood, drought, and pollution hazards challenge communities, cities, and regions on every continent.

At the same time, water innovations are booming at each scale, from moisture sensing at precise points in space and time to water-conserving environmental design; water policy experiments; and modeling of complex water systems at industrial, urban, regional, and planetary scales. Water-conserving design ranges from green roofs to rain gardens, bioswales, xeriscape irrigation, constructed wetlands, and more.

There are two key questions concerning these innovations:

1. Do these innovations scale such that they affect the broader-context of water problems facing societies?
2. Do these innovations diffuse so that they became effective solutions in diverse settings through replication, adaptation, and social learning?

What makes scaling so interesting at MIT is how it connects research and teaching in the:

- *Hydrologic sciences* (e.g., precipitation-soil moisture-land cover interactions; hydrogeology-contaminant transport processes; etc.)
- *Engineering* (e.g., water purification and treatment, conservation technologies)
- *Water economics and ecology* (e.g., water valuation in eco-hydrologic systems modeling and experimentation)
- *Water planning, policy, and design* (e.g., water-conserving design in buildings, sites, cities, regions, nation-states, and international river basins)
- *Water cultures* (e.g., comparative social research in different regions of North America, the Middle East, South Asia, Europe, etc.)

These fields currently cut across the five Schools at MIT, and will entail far more extensive collaboration to understand how water phenomena *scale-up*, *scale-down*, and *diffuse* across space and time to solve critical water problems.

Scaling-Up. How can local water solutions *scale-up* to create sustainable cities, regions, and systems? More specifically:

- How can site-scale water innovations be orchestrated to address larger-scale urban and regional water problems?
- At what point does adoption of site-scale innovations justify large-scale investment in eco-hydrologic infrastructure? (e.g., deltaic restoration, aquifer restoration, floodplain design, etc.)
- How do the water benefits of individual green roofs, stormwater best management practices, precision irrigation, water reuse technologies, etc., aggregate across different natural and built environments?
- How can we use design in nature for to understand water conservation in plants and animals in ways that contribute to the invention of devices and strategies for solving our water problems?

Scaling-Down. In some cases, downscaling is simply the inverse of questions such as those posed above, e.g., how does a regional water problem drive local innovations that address it? In other cases, global and regional insights lead to profoundly different understanding and implications at the local scale. For example:

- How can global climate model output be downscaled to generate credible river basin, aquifer, and smaller watershed scenarios of hydrologic change?
- How can greater knowledge of hydroclimatic teleconnections affect local water management impacts, decisions, and design?
- How do eco-hydrologic models at the landscape scale shape policy and design concepts at the local scale?

Multi-Scale Inquiry. Complex problems involve multiple scales, raising questions about:

- How multi-scale sensing and observing systems can enhance hydrologic sustainability at multiple scales.
- How water policy rules and procedures vary across scales, often in conflict with one another, but in ways that can generate productive experiments.
- Where should the system boundaries be drawn to understand the magnitude and reach of water use and associated resources (e.g., life-cycle water use of manufactured products, joint consideration of soil and water conservation in urban and regional systems).

Diffusion of Innovations. Implicit in the scaling of water solutions are their flows across space and time. These include flows of water itself, and “virtual water” contained in products and materials (e.g. water used in food, manufacturing, and trade). Diffusion research also focuses on innovations prototyped in one setting and moved or adapted in others. New research on scaling calls for new research on the dynamics of diffusion. For example:

- How are information technologies and new media transforming the paths, rates, mechanisms, and spatial distribution of water innovation?
- How can the U.S. shift from its 20th century emphasis on exporting water innovations to a balanced strategy of rigorous searches for and adaptation of innovations from around the world?
- How can robust water innovations be designed for application and adaptation in diverse settings (e.g. different climates, terrains, livelihoods, and cultures).

And ultimately, what role will MIT play in the creation, adaptation, and diffusion of water resource solutions – from campus to continents -- around the world?