Embedded Hydrologies - Combatting Water Scarcity through Local Water Capture

Miriam Ho
University of Waterloo

In a situation of rapid environmental change and resource insecurity, socially disadvantaged groups are often increasingly marginalized by unequal access to state infrastructure. In the Aral Sea crisis, an iconic example of unsustainable water management, subsistence farmers and fishermen whose livelihoods are threatened by desertification also lack the political and economic power to improve their own water access in the existing distribution systems. However, not only does the existing transboundary water network enable uneven distribution; a survey of the farmers' own perspectives reveal that cultural values associated with water and its use are influenced by the local visibility of water. Recognizing mechanisms in the everyday environment that prevent or promote water sharing can lead to more ecologically-sensitive urban design. A design method that draws upon local knowledge and materials to harvest water can empower disadvantaged communities and improve human relationships to the vital resource of water.

The "death" of the Aral Sea in Central Asia - which shrank from 68,000km3 to 5,000km3 in forty years - is primarily caused by water diversion for agriculture. The extensive irrigation infrastructure, built to enable prosperous industrial farming under Soviet rule, now facilitates water trade amongst former Soviet states with dams, reservoirs and canals regulating the movement of water to each country according to agreed quotas. Downstream communities rely on a distant water source and its uncertain flows through contested geopolitical spaces for their water supply. Individuals with political or financial power may improve their own water access priority using private pumps, and a cultural memory of water abundance associated with modern technology motivates this practice.

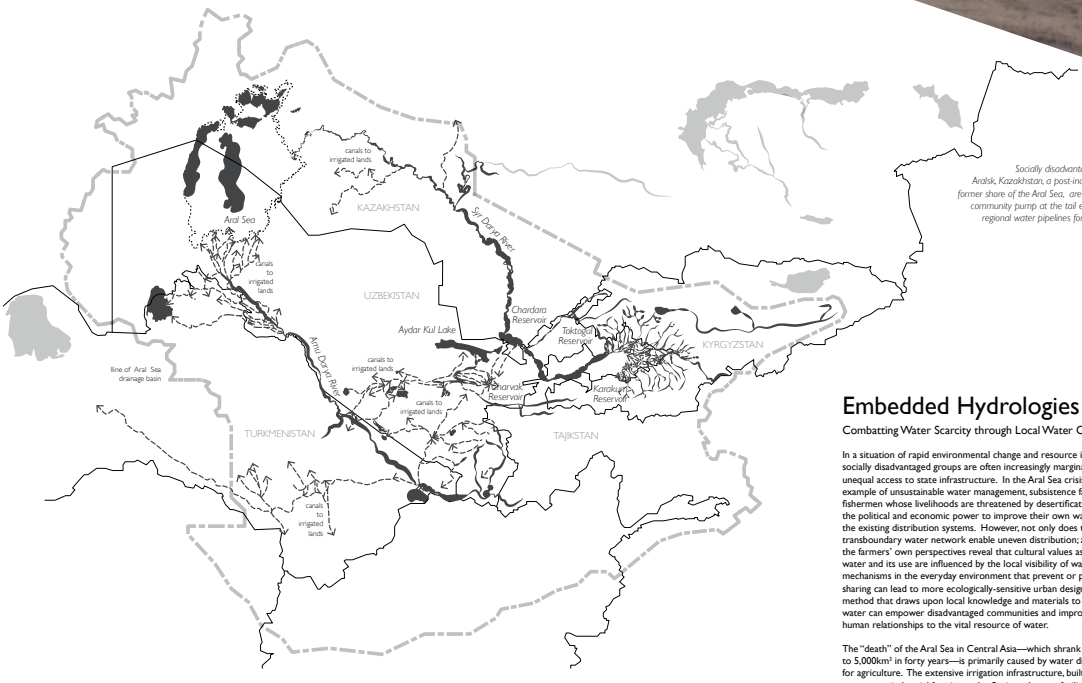
An alternative to the control and allocation of water resources is a model for local water harvesting, embedded in the materiality of the built environment. Creating a water-sensitive urban fabric that can empower local communities begins with a close scrutiny of water in the everyday environment and its impact on how scarcity is locally experienced. For rural groups in the Aral basin, linear systems of water delivery through modern infrastructure conflict with traditional beliefs of water as a God-given gift and a shared responsibility; far from limiting water use, consumption patterns are exacerbated by religious values that free-flowing water in the canals should not be wasted or left to evaporate. Sociological studies indicate that a mentality of water-saving is challenging to endorse in the absence of water storage spaces within the community.

Vernacular examples from this region of ancient oases show that water can be captured, filtered and distributed through urban material interfaces to create cities with self-sustainable water cycles. Traditional building technologies and nature-inspired material systems interact directly with climactic forces and are capable of harvesting atmospheric moisture and retaining water, holding tremendous potential to restore local water sources.

By increasing the visibility of water in the urban landscape and fostering more intimate connections to the dynamic water processes, this can not only augment local water access, but can promote better water stewardship.

/ ABOVE /
photo by author

Socially disadvantaged populations in Aralsk, Kazakhstan, a post-industrial town on the former shore of the Aral Sea, are dependant upon a community pump at the tail end of the local and regional water pipelines for their water supply.



"There will be water as long as the heads of the countries [...] get along."
— Khorezm farmer

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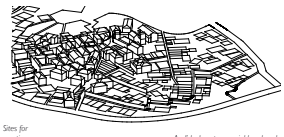
[1] Oberkircher, Lisa and Anna-Katharina Hornidge, "'Water is Life'-Farmer Rationales and Water Saving in Khorezm, Uzbekistan: A Lifeworld Analysis." Rural Sociology 76(3), 2011. pp.394-421..
[2] Ibid.

/ EMBEDDED URBAN WATER FUNCTIONS /

/ URBAN SYSTEMS / catchment storage distribution recycling



Sites for Intervention

Aral'sk downtown neighbourhoods

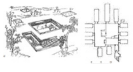
/ FORMAL SYSTEMS / catchment growth storage

Courtyard House Typology

/ MATERIAL SYSTEMS / absorption filtration growth

Local Materials and Craft

Vernacular Precedents



Settlements founded on Hydrological Layouts courtyards as water catchment and storage

source: Laureano, Pietro. The Water Atlas: Traditional Knowledge to Combat Desertification. Barcelona: Lasa Libros, 2005. Print.

Water Catchment Devices hypogeal (underground water storage rooms), water condensation chamber

source: Laureano, Pietro. The Water Atlas: Traditional Knowledge to Combat Desertification. Barcelona: Lasa Libros, 2005. Print.

Building Materials that Percolate (basalt) and Filter (sand/clay)

source: Pries, Eleanor. "Branner Fellowship Summary: Drip | Dry : Systems That Seep." Architect. N.p., n.d. Web. 1 Apr. 2013 url: *http://archinect.com/features/article/104336/branner-fellowship-summary-drip-dry-systems-that-seep.*

/ TOP LEFT /
Uncertainty about local water supplies are linked to the transboundary nature of a linear hydrological infrastructure

/ RIGHT /
Multi-scalar systems for embedded hydrologies that work as part of the water cycle

University of Waterloo School of Architecture 7 MELVILLE ST. S / CAMBRIDGE, ON / N1S 2H4 www.frmlab.com/author/miriamho

Miriam Ho
miriam.ho@frmlab.com