

REFERENCE:

Mohammed, Thamer A., Noor, Megat J. M. M., Ghazali, Abdul H. (2006). Study on potential uses of rainwater harvesting in urban areas. Faculty of Engineering, University Putra Malaysia
Retrieved from <https://www.researchgate.net/publication/229050053>

1. What was the problem explored or the question asked by the article? What was the author trying to accomplish? *This should identify the overall issue under consideration - what were their goals? Are they exploring something? Explaining? Trying to convince you? What is the issue?*

The authors present a problem in relation to water supply and demand, and posit solutions to a sustainable, conservationist way to address this issue years ahead.

As urban population continues to grow exponentially faster than that of rural areas, the demand for water increases, both potable and non-potable. Water supplies from current water resources are estimated to be only 2% of the water available in nature. The authors state that due to the foreseeable increase in demand it is imperative to take sustainability of supply in the planning and management of water resources. In urban areas, rainwater can be collected directly, or from roofs of structures, catchment areas, and open areas. Integration of rainwater harvesting system with existing conventional water supply will contribute to sustainability of supply.

2. What points does the author use to prove their thesis or accomplish their goal?

You should provide a "walk through" of the article or paper. What are all the key points? I should understand not only the content of the paper, but the order in which it is presented, and how the points relate to one another.

The article immediately goes into supporting arguments for the crisis mentioned in the introduction. From the arguments they segued into types of solutions (rainwater harvesting systems and requirements). There are additional persuasive points mixed in the solutions and description of systems sections of the article.

1. Background and Persuasive arguments:

Climate change can bring about extreme climate events such as drought and flood, which affect the utilization of water supplies and resources. To reduce this impact and overcome drought periods, many countries have adopted strategies to conserve resources and to promote use of rainwater for irrigation and other purposes. For example, in the Arabian Peninsula rainwater was used to recharge the groundwater and impounding structures to help food production and vegetation growth; in India traditional village tanks, ponds and earthen embankments still harvest rainwater and encourage growth of vegetation.

Other reasons for the importance of using rainwater harvesting to overcome shortage:

- (1) over half of the accessible freshwater runoff globally is already appropriated for human use;
- (2) more than 1 billion people lack access to clean water and almost 3 billion lack basic sanitation services;
- (3) human population will grow faster than the amount of accessible;
- (4) climate change will cause a general intensification of the earth's hydrological cycle in the next 100 years: increased precipitation, evapotranspiration, storms and changes in water quality.

Support for local innovations on rainwater harvesting could provide substantial amounts of water and reduce impact on water supply systems. Local practices such as using ponds and earthen embankments to store rainwater can be considered in rural areas.

Rainwater harvesting can provide arsenic-free, safe water in a cost-effective manner, particularly for potable use.

The treatment of harvested rainwater in areas where pollution is uncontrolled is a challenge, but it is possible to use nanofiltration for the removal of hardness, natural organic material, micropollutants such as pesticides, virus, bacteria, salinity, nitrates and arsenic.

With the right policies, rainwater harvesting can be a sustainable strategy to conserve water resources in an era of intensive climate change.

2. Systems Descriptions:

Domestic Use: Can be for both for potable and non-potable uses. Potable: drinking, bathing, cooking and dish wash. Rainwater must be treated to remove the contaminants. Non-potable: flushing toilets, watering garden and washing floor and treatment of rainwater is not required.

Six basic components: the roof (catchment), gutters and down pipes, primary screening and first flush diverters, storage tanks, the pipes, and water treatment unit.

Authors then provide methods and equations to calculate water availability and consumption as well as caveats in relation to what uses would require decontamination and to air pollution that might render the rainwater itself unfit for potable use in some areas of the world. Also provided are some water quality tests (pH, turbidity, conductivity, hardness, total suspended solids, and coliform colony count).

Experiment:

A harvesting system was installed at the university with the main objectives of defining ideal tank size as well as to study the quality of the water collected.

Irrigation Use: Has three components, the supply (or catchment), the demand (the landscape need), and the conveyance system. Storage can be added to the system if necessary. The volume of rainwater planned to be used for irrigation depends on rainfall

intensity, duration, and frequency, the degree of saturation for catchment ground surface and its nature.

Plant selection and density should be appropriate for region (low rainfall, fewer plants and plants with low water needs).

Environmental and Economic Benefits:

The irrigation water is not taken from storage allocated for municipal water supply;

Reduce groundwater exploitation, flooding, control erosion and improve water quality by holding storm runoff on the site, and cost reduction.

Rainwater is free from salt and can reduce salt accumulation and contribute to a good soil environment for root growth.

Types of Systems:

Simple: water dripping from a roof catchment area into a planted bed or diversion channel; gutters, downspouts, sloped surfaces, hillsides, swales, channels and ditches all can convey water directly to where it's needed. Curb cutouts, pervious blocks.

Complex: suitable when gravity flow is not possible AND water can be stored in natural depression, or constructed pit or tank with pump. It's costlier and better for large facilities. Cost of storage may exceed the cost of public works water but promotes conservation.

3. Adequacy: Must compute monthly supply:

Equation: $S = A \times R \times C$ where: (S: Monthly yield of rainwater harvest) = (A: Catchment area) \times (R: Monthly Rainwater depth) \times (C: Runoff Coefficient)

And volume of water required by plants:

Equation: $D = E_{To} \times \beta \times A$ (4) where D is monthly water demand or volume of irrigation water, (E_{To}) is monthly evapotranspiration, β is the plant factor, and A is the irrigated area.

“Water harvesting cannot provide a completely reliable source of irrigation water because it is dependent on the weather, and weather is not dependable.”

4. Conclusion: Circular logic. Instead of concluding findings and conclusions, authors repeat the perceived benefits that led to the investigation of systems and methods.

3. Was the article convincing? Why? *Consider the style of the writing, the format, the way the argument was structured, not just the content itself. Was there obvious biased? Did you agree with them before and this just reiterated your position? Etc., etc. What was left out? Why? It isn't possible to present a paper from all points of view and still have it be coherent and succinct. Identify one or more alternate points of view which would be appropriate but were neglected (e.g. The community's, the designer's, the public's, children's, the stakeholder's, the religious community, the environmentalist community, a Marxist, democratic, republican, gay, men's, women's, environmental, ecological, long term, business, financial, municipal, governmental, non-Western, non-White, etc., etc. Did this make the article more or less convincing?)*

The article was informative. It explained the several types of systems and uses, and provided formulas to guide the sizing and design of such systems. The organization of data could have been better with arguments presented together and a clearer thesis presented up front.

This is a subject that interests me a lot. I was looking to add to my understanding of how to implement runoff systems to projects and the article did provide me with data I was missing.

While the article presented many compelling (at least to me who am conservation-minded) reasons to utilize rainwater harvesting for small scale urban irrigation, it did state that in larger systems the cost of storage is larger than the cost of public water. With that, it leaves to the designer to figure out how to convince a client to spend money on a system that will cause them to spend more money on irrigation. While I don't think I personally would have a problem

“selling” a client on this idea due to how strongly I believe in protecting our of natural resources and my many decades operating as my own design salesperson, perhaps some case studies could be included of clients that decided to install it despite the cost giving their reasoning to help younger designers form their own arguments to present to stakeholders.

6. Why is this issue important in landscape architecture?

If it isn't important, say so. If it is, state how and why. Consider this: there is a reason why (a) it was written, (b) it was published, and c) I chose it as a reading for the course. Try and figure out why...

It is a key issue. Urban population continues to grow and water infrastructure is a key element that impacts our field. No project that we design should ignore the methods and usage of public water and a responsible Landscape Architect will make every effort to not abuse this natural in the community there are working. It is one of the most important social responsibility aspects of our work.