Chapter 5

Mexican rainwater harvesting movement in recent years

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5.1 RAINWATER HISTORY IN MEXICO

In Latin America and especially in Mexico, rainwater harvesting (RWH) has been a technique developed and practiced since before the Spanish conquest. The Mayan and Aztec cultures captured and distributed rainwater using channels for drinking and irrigating their crops during the dry season.

Mexico has invaluable experience with rainwater harvesting. The Mayan "Chultuns" (Figure 5.1) used since the late pre-classic period was a common practice to save water for crops and supply water for people. The Chultuns were underground excavations waterproofed with gesso (González De la Mata, 2003). In Oxkutzcab at the skirt of Puuc's mountain, the water was captured at an area of 100 to 200 m^2 and stored in Chultuns for later distribution (McAnany, 1993).

Unfortunately, all the advances for the implementation of rainwater harvesting were used less frequently after the Spanish conquest. Mostly the rainwater

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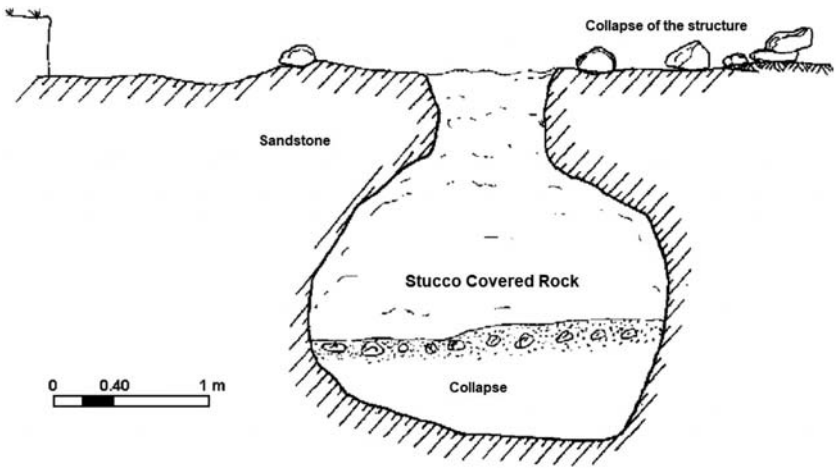

Figure 5.1 Chultuns in mayan culture. (*Source*: González De la Mata, 2003).

harvesting systems were replaced by the construction of aqueducts, wells, and Spanish agricultural practices.

Another factor that helped reduce the use of rainwater was population growth. Between the nineteenth and twentieth centuries, most of the world had dramatic population growth. As a consequence, the demand for water skyrocketed. This large amount of water was and even now is supplied by aqueducts and centralized water supply systems. However, in recent years, rainwater harvesting is gaining interest again worldwide. Rainwater is used not only to store water for dry periods but also as a measure to cope with extreme rainfall (Hofman & Paalman, 2014).

5.2 RAINWATER IN 21ST CENTURY MEXICO

Every day the water supply sources get more affected by overexploitation, poor management, and climate change. As a consequence, millions of people suffer from a lack of supply of good quality water (UN, 2018). As a result, water takes greater relevance in societies, whether there is not enough for basic needs or because water pollution causes damage to health or floods.

In Mexico, most of the water consumed comes from a threatened lake, river, or an overexploited aquifer (CONAGUA, 2015), both requiring an enormous amount of energy (WWAP, 2015). Therefore, rainwater harvesting is regaining power as an alternative water supply. Among the most representative efforts of the implementation of rainwater harvesting is in Mexico and one of the pioneers of this technique is Dr. Manuel Anaya Garduño, a professor from the Graduate School (COLPOS) in Texcoco, State of Mexico. He designed a rainwater

Figure 5.2 Tlaloque Urban Island. (*Source*: Isla Urbana, 2019).

harvesting system to help solve the problem of drinking water for the benefit of more than 150,000 rural people in communities that lack infrastructure. The system consists of catching the rainfall from roofs, storage in tanks, and conveyance to a purification plant, where the water is purified, and used in the community.

Dr. Manuel Anaya is also the leader of the academic rainwater harvesting systems network, sponsored by the Science and Technology National Council (CONACYT). This network has the objective of exchanging ideas, experiences, and innovations of rainwater harvesting systems to contribute to solving water scarcity problems, especially in marginalized areas.

To the efforts of Dr. Anaya are added the creation of Urban Island (Figure 5.2), a Non-Governmental Organization focusing on the south of Mexico City. The municipalities of Tlalpan, Iztapalapa, and Xochimilco live in a water paradox of water scarcity and floods.

Frequently houses of this area do not receive water supply for weeks, receive poor water quality, or do not have water services at all. The lack of a good water supply forces families to purchase water carried by truck, this can become very expensive and unaffordable for people in the area, and still be very irregular.

Figure 5.3 RWH in Mexico City. (*Source*: Sedema, 2019).

Figure 5.4 Tarahumara's RWH. (*Source*: Captar A.C 2019).

Consequently, Urban Island has been working in those municipalities installing rainwater harvesting systems to supply water to those families without water services. Tlalpan and Xochimilco are two of the most impacted communities, with almost 4,000 rainwater harvesting systems installed by 2018, and more than 23,000 benefited people (Isla Urbana, 2019).

Another sample of the rainwater harvesting evolution in recent years is the case of San Felipe, a community located in the State of Guanajuato, Mexico, at an altitude of 2,140 meters above sea level, with high temperature and desert-like climate. The "Water and Life" project began with the implementation of tanks in 1996. The first technological development consists of a rainwater system with a storage capacity of 500,000 liters and a catch covered by stone.

In some places, the struggle caused by water scarcity and poor water service creates a severe crisis in the population. For example, in 2005, a drought attacked Ocotlan's Valley in Oaxaca, and for over ten years, the people watched their crops die because of lack of water. The water crisis in this indigenous community made them look for alternatives to survive, that's how nowadays hundreds of farmers harvest and infiltrate the rain every year. Using the rainwater during the dry season, the farmers grow fruits, vegetables, and roses (EFE, 2019).

Social initiatives have been emerging to supply water where homes suffer from severe scarcity or/and inadequate water quality. NGO's and sometimes the local government join forces to reach the maximum number of people possible. That is the case of the rainwater harvesting (RWH) program recently launched in Mexico City. The Environmental Secretariat and Isla Urbana (Urban Island) together started a plan to install 10,000 RWH systems (Figure 5.3) in areas with severe water scarcity, especially in Xochimilco and Iztapalapa. This initiative aims to improve water access conditions, reduce floods, and save money and energy to the families.

Another excellent example of the expansion of good practice in the country is the work of Captar A.C, focusing on the wellbeing of the Tarahumara's indigenous

community (Figure 5.4) located in the northern state of Chihuahua. Captar seeks solutions that influence fundamental problems for the people in the zone. The realization of technical and demonstrative workshops are an essential part of the process with the community. Since 2006, Captar has been installing rainwater harvesting systems, creating family farms, etc. They aim to help and work with people living in extreme poverty to create good quality and long term systems.

However, to discuss water problems, it is necessary to explore causes, to establish appropriate solutions based on multidisciplinary approaches. As a consequence, the University of Guadalajara (UDG), through the academic group Management and Technology for Architecture and Sustainable Urbanism and the Sustainable Urban Architectural Technology Laboratory (LATAU), were pioneers developing prototypes of RWH in households and universities campuses. Besides, the University generates data through a network of weather stations located all around Guadalajara's Metropolitan Area in collaboration with the Technological Water Research Lic. Arturo Gleason Santana (IITAAC). Since 2013, IITAAC has been promoting theoretical and applied research projects, programs that provide concrete answers to the challenges in water issues that overwhelm society and the environment.

IITAAC is a Non-Profit Organization seeking to promote water culture around the community through environmental education focusing on children and students. Using the Stormhunter truck (Figure 5.5), IITAAC can visit communities, schools, businesses, parks, etc., to share science and water education with the community, such as rainwater harvesting systems.

Figure 5.5 IITAAC's Stormhunter. (*Source*: IITAAC, 2017).

Figure 5.6 Sky Ha' Rainwater. (*Source*: Sky Ha, 2018).

5.3 RAINWATER AS AN INDUSTRIAL APPROACH

By 2030, according to the UN, total global water demand is expected to exceed supply by 40%, and approximately half of the world's population will suffer from water stress. Agriculture followed by industry is the most significant freshwater users, and the demand for water in manufacturing is expected to increase by 400% by 2050 (WWAP, 2015).

Sometimes rainwater can be seen just as a domestic or agricultural water supply. On the contrary, rain can be used as a part of the production chain or even as a raw material.

Sky Ha' Rainwater is the perfect example of rainwater as a raw material. Sky Ha' is a social and ecological enterprise that was founded to create natural products that promote the well being of humans and nature. All this is achieved by maintaining the highest quality standard and making use of sustainable technology and responsibility. Sky Ha' (Figure 5.6) is a company that catches, purifies, bottles, and distributes rainwater in hotels around the Mayan Riviera in southeast of Mexico.

In contrast, different companies like and Sistemas Pluviales in Mexico City, or Xocalli in Morelia are looking to develop integrated water management projects. Soluciones Hidropluviales (Figure 5.7) is a Mexican company focused on designing and developing projects involving rainwater and stormwater management. The company is a pioneer in generating and applying solutions for large urban catchment areas such as industries, shopping centers, housing developments, or municipal projects.

5.4 INSTITUTIONAL EFFORTS

5.4.1 Expansion of good rainwater practices

Population growth, water scarcity, lack of good water quality, and floods are some of the problems Mexican society faces every day. As mentioned in section 5.2 of this

Figure 5.7 Rainwater management in a public space. (*Source*: Soluciones hidropluviales, 2019).

chapter, in recent years, the rainwater harvesting movement has been skyrocketing around Mexico.

In the past 20 years, there have been different efforts to create a national collaboration to promote RWH regarding planning, development, management, and education. It all began with Dr. Manuel Anaya efforts at the 11th Rainwater Harvesting Systems International Conference in 2003, organized by IRCSA-Mexico.

The discussion, planning, and regulation are a crucial part of every practice and technology development. In 2017, the National Rainwater Catchment Systems Association (AMSCALL) was founded to promote sustainable rainwater practices and help restore the water cycle's health. AMSCALL seeks a national presence that generates opportunities for RWH, decreasing water shortages and floods.

In 2017 AMSCALL with the collaboration of IRCSA, the National Housing and Sustainable Communities Laboratory, University of Guadalajara (UDG), and IITAAC organized the First National Conference of Rainwater Harvesting Systems (CONAMSCALL by its initials in Spanish Congreso Nacional de Sistemas de Captación de Agua de Lluvia) in Guadalajara, Mexico. The 1st CONAMSCALL was a big international event and had a great attendance of people from all around Mexico and speakers from more than seven countries.

The institutional efforts to create a space where water professionals and people interested in rainwater can have discussions on planning, promotion, or regulation is essential for the development of the movement. That is why in 2019, AMSCALL presented the 2nd National Conference, this time in Morelia, Mexico. This time the main subject was Rainwater Harvesting for a Water Sensitive Mexico. The conference aimed to promote water management in cities and communities, oriented to the management and conservation of the water cycle, as well as to the optimal functioning of its urban hydrosanitary system. Rainwater harvesting becomes crucial in this process since precipitation is the entrance of water to the basin.

The 2nd CONAMSCALL focused on researchers, academics, architects, urban planners, engineers, as well as related professionals, students, NGOs, business persons, officials, government staff, the international community, and the general public interested in participating in rainwater harvesting.

5.4.2 Certification program to accredit professionals in rainwater harvesting

In past years, the implementation of Rainwater Harvesting Systems has been growing around all Mexico with the idea of increasing water for domestic, agriculture, and industrial supply. Furthermore, RWH has allowed a reduction in groundwater withdrawals and decreased stormwater volume.

For that reason, during the National conference of 2019, AMSCALL launched the National Certification Program for all businesses and people interested. All water professionals interested in rainwater should be evaluated every two years to continue with the certification.

The certification program comprises four levels:

(1) *Introduction to Rainwater Harvesting and Use: Promoter Certificate*.
This first program is aimed at those who are new to the rainwater world and requires basic knowledge about the water cycle and hydrosanitary systems.

(2) *Design of a Rainwater Harvesting System: Designer Certificate*.
This course is designed for building professionals or for those who wish to design a RWH system and aspire to develop a professional career in rainwater management.

(3) *Development of the Rainwater Harvesting System: Developer Certificate*.
Designed to provide knowledge about technical standards, pipes, design standards, calculations, installation of commercial and industrial systems, planning, and construction. Also, pumping systems, treatment systems, and practical application in the development of rainwater harvesting systems.

(4) *Supervising the Installation and Operation of Rainwater Systems: Supervisor Installation and Maintenance of Rainwater Harvesting Systems*.
This course aims to prepare professionals to supervise the installation and operation of rainwater harvesting systems by providing maintenance services. This course addresses professional skills to evaluate each component of systems to ensure its proper functioning.

The certification program content is based on the information from IRCSA, and the professional program created by The American Rainwater Catchment System Association. Additionally, every step was supervised and approved by the National Laboratory of Sustainable Households and Communities from CONACYT.

5.5 CONCLUSION

Historically, Mexican culture has had a strong relationship with water since the ancient prehispanic civilizations, developing rainwater harvesting techniques in the 10th century BC. Nowadays, the Mexican rainwater movement is getting stronger all around the country. However, it is still necessary to encourage higher participation in rainwater harvesting practices to build an extensive sector with a strong AMSCALL through the homologation, training, and affiliation of new members. Furthermore, to create consistent, reliable, and regulated systems, all the technological advances, and local experiences must be turned into technical rules that warranty an adequate system installation and function.

It is a significant challenge for the rainwater harvesting culture to be accepted in all sectors of the Mexican society and to settle on the basis of a transformation for sustainable water management. Finally, it is imperative to recognize all the people, NGO's, businesses, and universities who have been interested in promoting these significant subjects of water management and conservation.

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