

# **Water Conservation in Jordan: A Participatory Approach to Curriculum Development**

*Water scarcity is a serious problem in Jordan. A water conservation curriculum developed for secondary schools motivated students and their families to take action in their own homes, and introduced interactive teaching methodologies, in a gender-sensitive fashion, to school administrators and teachers.*

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Most North Americans do not think about water often. They take for granted that, when they turn on the faucet, there will be plentiful amounts of this natural resource at their finger tips, perfectly safe to drink and affordable. Yet, imagine living in a desert area, such as parts of the Middle East or Northern and Western Africa, where water scarcity dominates the national consciousness, and every drop is viewed as a precious and costly commodity.

Under such circumstances, who is responsible for reducing and policing water use? What role do businesses play? What role does government play? What can individuals do to conserve water? In the Middle East, the arid country of Jordan is grappling with these questions and more, seeking out new strategies to address its growing water needs in the face of dwindling supplies.

## **Background on Jordan**

The modern Hashemite Kingdom of Jordan was founded in and around the Jordan Rift Valley in the 1920s. The majority of its approximately 4.1 million people live in urban areas.<sup>1</sup> The population is young, with 43% of the citizens under the age of 15. Estimates of the percentage of the total population comprised of Palestinian refugees who left Israel in 1948 or 1967 range from 35-45%.

With the exception of a single port on the Gulf of Aqaba, which leads into the Red Sea and ultimately the Indian Ocean, Jordan is a landlocked country. Less than 7% of the land is arable and water is in extremely short supply. Jordan's natural resource base is limited by its small size and arid conditions, and virtually all of its oil is imported. With few resources to draw upon, the economic base of the country is small, and the service sector accounts for more than 60% of GDP. The unemployment rate stands at close to 25%, and is growing due to recent downward trends in the regional economy.

Despite these economic difficulties, the majority of the population has access to basic services,

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<sup>1</sup>Population Reference Bureau. *World Population Data Sheet, 1995.*

such as electricity and potable water, through household connections. In addition, education has remained a priority in the country, reflected by a high rate of literacy, approximately 70%. Particularly noteworthy is that the gains in literacy have come from increasing the number of girls in school. Over 90% of eligible children are enrolled in elementary school and approximately two thirds of eligible children attend secondary school.

In spite of the high rates of literacy, women's roles in Jordanian society, among both Islamic and Christian families, are largely traditional and revolve around domestic work, children and the extended family. Although laws do not discriminate against women with respect to salaries or retirement benefits, social emphasis on maintaining families means that women often do not work outside the home when they have children. For women who do work, the glass ceiling is still very much intact.

## **The Problem: Water Scarcity**

Paramount among Jordan's national concerns is water scarcity. The problem is so serious that the peace treaty between Israel and Jordan, signed in 1994, included Jordanian water rights. This landmark initiative addressed long standing political tensions between the two countries, and the terms of the water section are still being argued today. Extensive mass media coverage highlighting the agreement served to further focus the nation's attention on the water shortage issue.

Water is scarce across all three climatic regions into which Jordan can be divided: the Jordan Valley, which includes the Dead Sea; a mountainous region receiving occasional snowfall; and the Badia region, which is cold and dry. All regions are arid, or semi arid, with a dearth of water for farming, grass, and even trees.

Similar to tropical countries, Jordan experiences only two seasons, a rainy season and a dry season. The rainy season lasts from October through April, during which time the country receives 85% of its total annual rainfall. Precipitation is the predominant source of fresh water, feeding the Jordan and Zarqa Rivers and replenishing natural springs and underground pockets of water.

However, three problems curtail the availability of these fresh water resources. First, 92% of the rainfall is lost to evaporation. Second, over the years, Jordan's neighbors, Syria and Israel, have built hydroelectric dams further upstream on the Jordan River, diminishing water flow. Subsequently, Jordan has become highly dependent on these countries for its water needs. A third problem is that Jordan's population has expanded enormously due to successive waves of refugees from Israel and Palestine, and the increased population puts fresh demands on both agricultural use of water as well as domestic use of water. Finally modernization and increasing expectations about quality of life have also changed domestic water behaviors.

These multiple needs cannot be met by tapping new water resources, since at this time all known sources of water across the country are already being utilized. But this has not stopped the demand for water from growing. Both industrial and household water usage have risen in recent years. At the same time, Jordan's highly developed agricultural sector, the largest consumer of water, requires increasing amounts of this scarce resource.

Yet historically, inhabitants of the region were very efficient users of water. From ancient Nabatean (an Arabian tribe) times in the 6th century B.C., on through the periods of the Romans, the Jews, Christianity and the Ottomans, Jordanian cultural resources reflected a respect for this scarce resource. Archaeologists have uncovered cisterns and wells, stone water channels carved in rock cliffs, and inscriptions on mosaics and frescoes alluding to the need to protect and provide water to the early occupants. The spring discovered by Moses is one of the stories and miracles that surround water in the region. On the desert highway between Aqaba and Amman, known as the King's Highway, a restored Roman cistern filled with water dramatically reveals how travelers and nomads in the region depended on water collection for survival. With modernization, piped water and pump technology, the dependence on rainwater collection gave way to a dependence on ground water and aquifers. The collection channels fell into disuse, and the intricate cistern and reservoir system collapsed.

For these reasons, combined with the fact that Jordan has one of the highest population growth rates in the world (3.3%), the water supply no longer meets demand. Conservation efforts thus focus on more efficient management of existing water resources, and rationing of water has become a way of life. Recently, legislation was passed that requires newly constructed homes and apartment buildings to have water storage tanks fed by runoff rain water in addition to piped water. But regulation and municipal management alone will not suffice to resolve Jordan's water deficit. Although Jordanians are now fairly efficient water users, additional voluntary reductions of water should also be undertaken at the household level.

## **Do Males and Females Perceive the Water Problem Differently?**

In order to answer this question and others, the Royal Society for the Conservation of Nature, a local non-profit environmental organization supported with technical assistance from the GreenCOM Project<sup>2</sup>, held a series of discussions with students, teachers and principals in 1994. The results showed that both boys and girls were well aware that water was an issue in the country. However, there was relatively little understanding that water scarcity was not a new issue, indeed had been a problem for centuries. There was remarkably little understanding that water scarcity was an endemic feature of a climate that is essentially arid or semi-arid.

Furthermore, as suspected, males and females did perceive their roles in conserving water very

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<sup>2</sup> The Environmental Education and Communication (GreenCOM) Project is funded by the United States Agency for International Development (USAID)

differently. While men/boys saw their role as social promoters of water conservation, women/girls saw their role as implementors of conservation measures. Men more often mentioned the need for public or government responsibility for the issue; women were more apt to personalize conservation measures. For example, when asked for specifics, males could only state one or two ways to reduce water use in the home, often linking water reduction and conservation to those tasks that women were most likely to do (e.g. washing dishes and doing laundry) and less likely to talk about their own uses of water (in the garden, washing cars, shaving, taking showers). Few talked about water wastage through old and corroded pipes, and leaking water tanks, one of the principal ways in which water is lost and which would normally be a man's/boy's job to repair. In contrast, females generally offered several ways to reduce domestic water consumption linked to their own household tasks and personal use.

In general, Jordanians of both sexes believe that females care more about and are more responsible for safeguarding the environment than males. This attitude may stem from traditional Jordanian society when women were responsible for fetching water from the wells and allocating it for household use. Women/girls also indicated a more refined sense of the kinds of water available for domestic use and were able to distinguish between grey water, which many girls knew could be recycled, to rainwater (which was often preferred for cooking and drinking), to spring water (purchased in time of water shortage and also used for cooking and drinking) and tap water, which was used for washing laundry and watering the garden. It is not unusual in Jordan for women to have three separate sources of water (tap, spring and rain), each of which has its own specific usage.

Many of the students, teachers and principals interviewed believed that they have no control over the country's water supply. For example, although most of those interviewed believe the national water shortage is a man-made problem, caused by a combination of government mismanagement, industry dumping and domestic abuse, most also believed that the solution had to come from Government or industry. The students did not see themselves in the role of concerned consumer or environmental advocate, even though the group of youth and adults were linked to environmental clubs. Although students generally are knowledgeable and aware of water problems in Jordan, they do not feel that they can contribute to any solutions.

These public attitudes and beliefs, in conjunction with external political circumstances, create a significant challenge for promoting water conservation behaviors among Jordanian students and their families.

## **A Water Conservation Curriculum**

RSCN decided to help tackle the water scarcity problem at the household level. In an effort to instill a sense of personal control over water usage and spur Jordanian citizens to action, RSCN developed a water conservation curriculum for its network of secondary school environmental

youth clubs (eco-clubs).<sup>3</sup>

RSCN started its loosely structured school-based eco-club system several years ago, and it has now grown to include over 300 clubs. Although the club's initial focus was on biodiversity, RSCN became increasingly concerned about the growing urgency of the water shortage problem in Jordan. RSCN further recognized that its eco-club system provided a good avenue for testing new approaches to environmental education. Schools, which are single-sex in Jordan, volunteer to join the eco-club system and most students volunteer to participate in the club's activities. As a result, eco-club students and teachers are generally highly motivated, and consistently express strong interest in improving their clubs. The majority of participating schools consist of girls' schools, further highlighting the link between environment and gender by reflecting the traditionally greater interest and involvement of women/girls in environmental conservation.

The curriculum RSCN developed for its eco-clubs focused on persuading students and their family members about the need to conserve water at home, and provided examples of specific actions they could take to reduce their personal water use. Taking into account the earlier discussions with boys and girls, particular effort was made in the curriculum to highlight things that boys/men could do to personalize their commitment to water conservation. The curriculum consisted of the following five units:

- 1) The water cycle in nature and water sources in Jordan;
- 2) Reduction of household water use;
- 3) Ground and surface water;
- 4) Ground and surface water pollution; and
- 5) Home gardens and irrigation.

Because the goal of RSCN's efforts was active participation in water conservation by students and their families, the curriculum stressed interactive learning activities. Each unit included an information section with facts about the topic under study, questions to facilitate discussion, activities for the club, and a student test to be administered before and after the unit. ***Several examples of these club activities are provided on the opposite page (LAST 2 PAGES).***

Activities conducted by the clubs were then linked to a number of specific actions recommended for students and their families to perform independently at home, including:

- Placing a one-liter bottle in the toilet tank to reduce amount of water needed to flush;
- Watering the home garden in the morning or evening, not in the daytime, to reduce evaporation;
- Taking showers instead of a bath;
- Turning taps off while brushing teeth, washing dishes, and shaving;
- Washing clothes in one large load instead of many small loads and reusing the grey water

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<sup>3</sup>Technical assistance was provided by the GreenCOM Project.

- Repairing old water tanks and covering and cleaning cisterns; replacing corroded and leaky pipes.

## **Curriculum Development and Teacher Training**

RSCN staff, several teachers, officials from the Ministry of Education, GreenCOM staff and other experts in education, water, the environment, and administration came together in a participatory workshop in October 1994 to develop a water conservation curriculum in Arabic. Although a few of the participating teachers had science backgrounds, others were trained in Arabic language, religion and other specialties. The contributions of the non-science teachers were vital because eco-club teachers' backgrounds vary from science, to language arts, to mathematics, to religious instruction and art.

The educational theories which guided the design of the curriculum placed importance on the role of interactive discussions, hands-on experiments and discovery processes in student learning, and the need to make topics relevant to teenagers' lives. Although these methods have become widely used in many Western nations such as Canada and the U.S., this constituted a dramatic departure from the traditional school curricula that rely primarily on a lecture format.

Curriculum content was based on information gathered from the interviews conducted by RSCN with students, teachers and administrators, as well as activities adapted from existing curricula from the United States and elsewhere that incorporated interactive teaching techniques. In particular, the curriculum drew on activities used in science curricula from Arizona and New Mexico, which are similar in climate and topology to Jordan.

During the curriculum development workshop, teachers themselves demonstrated, in their entirety, the activities they expected students to be able to perform. In this way they could monitor the availability of materials called for in the exercises, the ability of teachers to understand the concepts, and the ability of the students to perform the task at the grade level. At the same time, they were able to determine how long a given task would take so that the one hour a week normally devoted to eco-club activities would be respected.

The degree of academic difficulty was pitched to a 9th grade level so that younger students would not find it too difficult and older students would not find it too boring. 8th, 9th, 10th and 11th grade students participated in the project. Initially it was hoped that students too would participate in the curriculum development workshop, but this did not happen due to objections from teachers. Subsequently, RSCN has included students successfully in similar efforts.

Sensitivity to the different roles males and females play with respect to water was emphasized throughout the design process. For example, a deliberate effort was made to include exercises and activities that would affect both genders. When advocating behavior change in the home, the curriculum included illustrations of men closing faucets while they shaved, men using drip

irrigation rather than hoses in family gardens, and men washing cars with buckets rather than a hose in addition to women washing dishes and clothing.

The curriculum also had to be tailored to both rural and urban schools. One example of how this was accomplished was by including activities that addressed both home garden watering (urban or rural) and irrigation of agricultural land (rural).

During the same two week curriculum development period, all the materials, exercises and teacher's guides were pre-tested with eco-clubs and their teachers, and in the case of some chapters, the revisions were again pretested. Next, RSCN and other curriculum development team members trained eco-club teachers how to use the curriculum at a series of two-day workshops held in January 1995. At the training, teachers were provided with the curriculum and a self-instructional teaching manual that stressed the new interactive teaching methods. The participants "walked through" the teachers' manual, following the instructions step-by-step to ensure a thorough understanding of the lesson.

### **The Interactive Curriculum Worked!**

An evaluation conducted at the end of the semester compared students and teachers from a sample of eco-clubs where the new curriculum had been introduced with a sample of eco-clubs that did not receive the new curriculum. Results suggest that the curriculum had a significant impact on students' knowledge, attitudes, beliefs and behaviors regarding conserving water at home. Of particular interest is the stronger effect the curriculum had on boys than girls with respect to students reporting that they made suggestions to their parents about ways to reduce water consumption, such as shutting off the tap while brushing their teeth. This finding suggests that when the practice of water conservation is presented as an issue within the male domain, boys are receptive to the subject matter and can become advocates for change.

In addition, students appear to have served as a conduit for changing their family's water conservation behaviors at home as well. Participating students reported influencing the clothes washing behavior of their mothers as well as their households' garden watering practices.

The curriculum also appears to have influenced teachers, changing how they conducted their eco-clubs in terms of the content and format of the activities carried out. Most teachers who were provided with the curriculum (60%) implemented the majority of recommended activities. Female teachers were more strongly impacted by the curriculum than male teachers, as they increased both the total number of activities on water and the number of *interactive* water activities (e.g. field trips, experiments, drama presentations) used in their eco-clubs. Male teachers who received the curriculum increased the number of *interactive* water activities they used, but did not devote more activities in their eco-clubs to water issues overall.

Importantly, teachers' reactions to the new curriculum were overwhelmingly positive and the

vast majority (90%) indicated they would like to use the curriculum again in the future with new eco-club students.

## **Looking To the Future**

What does the success of this curriculum imply for future environmental education efforts in Jordan and elsewhere in the Middle East? The extensive knowledge RSCN gained about teacher and student behavior, and implementation of an ecology club program with gender-based considerations, should prove useful in improving its school-based environmental programs in a number of ways. This includes making them more responsive to teachers' needs.

The success of the curriculum in motivating students and their families to change their behavior indicates that the learning approach embraced by the curriculum can serve as a model for new educational projects by other organizations in Jordan. Appropriate in both formal and non-formal settings, the interactive teaching methods used here can also be replicated and adapted to other subject areas with relative ease.

The diffusion of ideas has already begun. At the close of the project, other divisions within RSCN had used their newfound skills to develop materials to promote tourism at park sites. RSCN education staff used the participatory workshop model to develop a curriculum on biodiversity and conservation of species in Jordan. Teacher training was not included in that activity and teachers complained that they had difficulty in application of the materials without going through their own training. The participatory model was much appreciated by USAID, which recommended it to all its projects in Jordan. Subsequently, it has become a standard for other programs and projects across the country.

More broadly, neighboring Middle Eastern countries that face similar water shortages may look to Jordan in the future for fresh ideas in revamping their own water conservation strategies. Copies of the curriculum are already being implemented in select schools in Palestine and the West Bank, and Egypt's schools have also requested and received copies of the materials for their own use. RSCN went on to develop a series of TV spots based on the recommendations in the curriculum (one spot a month for six months highlighting a specific way citizens could conserve water), which were used in prime time on national TV and were widely and well received, not only in Jordan but in neighboring countries where reception of Jordan TV was available.

But most importantly to Jordan, the curriculum represents a vital contribution to efforts to create a gender-sensitive dialogue about water conservation at the household level, empowering students and their families with the information required to personally contribute towards solving the serious water shortage problem faced by the nation.

## Sample Activities From the Curriculum

### *Unit 1-The Water Cycle*

This unit highlights the importance of water in nature, its role in the Koran, and its many uses. Background information is provided about water sources in Jordan, the water cycle, dams and the concept of water as a publicly owned commodity. Collection and use of water over time is outlined. The impact of population growth and urbanization on the water supply is described.

Activity 1: Exploring How Water Evaporates  
Summary: Put equal amounts of water in 2 bowls or glass and cover. Place one bowl in the sun, and another in the shade and compare what happens.

Activity 2: Constructing a Small Replica of the Water Cycle  
Summary: Put soil, water and seeds into a covered jar to see if and how the plants grow. In each case, first write down what you expect to see, then perform the experiment and record and discuss what you actually observed.

### *Unit 2-Household Water Use*

This unit reinforces the importance of water and its scarcity in Jordan and throughout the Middle East. These concepts are then brought into the home environment by presenting several ideas for saving water in the bathroom, kitchen and elsewhere in the house.

Activity 1: Water Use Survey  
Summary: Conduct a survey at home with your parents to measure how much water your family uses. Record how much water you and your family use for brushing teeth and bathing. Next, determine how much water is used for “female” household tasks such as washing the dishes and the clothes. Determine the amount of water used for “male” tasks such as washing the car and shaving. Discuss with your family ways they could decrease water consumption.

Activity 2: Water Meter Reading  
Summary: Observe the teacher’s demonstration of how to read a water meter. Next, check your water meter at home, or look at your family’s water bills if they purchase water, to calculate the cost of water to the family each month. Compare and contrast the water bill from the month prior to implementing the water-saving measures you have learned at home, and the month after implementing these measures.

Activity 3: Saving Water When Brushing Your Teeth  
Summary: Calculate how much water can be saved when the tap is not left running while you brush your teeth. Multiply this amount by the number of people in your family to determine the total savings for your household.

### ***Unit 3-Aquifers and Surface Water***

This unit introduces the concept of underground (aquifer) and surface water. Student discussion centers on the issues raised by a hypothetical conversation between two friends -- Hamid and Hamed -- from different parts of Jordan. They talk about their surrounding areas, both of which have become drier in recent years, and how they have seen birds and wild life disappear. They talk about their fears that water might not be available in the future and discuss the difference between renewable and non-renewable water sources. The importance of ground cover is also stressed in this exercise. In Jordan, ground cover is often removed through gleaning activities, which allows water to evaporate faster and removes habitats of small animals.

Activity 1:     Function of Ground Cover in Retaining Moisture

Summary:     Put seeds and wood chips in a nylon sock, place it on a wet plate, and observe what happens over the course of two days.

### ***Unit 4-Pollution***

This unit addresses surface water and aquifer pollution: the role that humans play in causing pollution and ways to stop it. Particular emphasis is placed on pollution in the Gulf of Aqaba and its effect on coral reefs. Six suggestions to decrease water pollution, such as minimizing the use of chemical fertilizer and controlling garbage disposal, are offered.

Activity 1:     Simulating Water Pollution

Summary:     Fill a glass with water, sand, and pebbles. Put ink, red dye and oil into the glass and observe what happens.

### ***Unit 5-Home Gardens and Irrigation***

This unit explores ways to reduce water use in home gardens. Water-efficient plants that can be used in gardens are identified; how compost can slow evaporation of water is demonstrated; and the effects of fertilizer on evaporation levels is examined. The unit shows how to collect rainwater at home for use in home gardens. The advantages of drip versus canal irrigation methods for agriculture are also covered.

Activity 1:     Comparing Water Use by Three Different Plants

Summary:     Obtain three different plants with different sized leaves. Observe how much water is used by each plant over time.

Activity 2:     Comparing Waxy Versus Non-waxy Leaves

Summary:     Identify two plants, one with waxy and one with non-waxy leaves. Compare transpiration between the two plants over time.

Activity 3:     Simulating Canal and Drip Irrigation Techniques

Summary:     Water one group of plants with a pitcher of water (canal method) and another group of plants with a water dropper (drip method). Observe over two weeks to see how much water is used by each. Take notes and present your final results.