An Educator's Guide to

SOLVING THE WORLD'S WATER CRISIS: WHAT CAN WE DO?

Curated by:

RootOne

ISRAEL21c CELEBRATES 20 YEARS

THE JEWISH EDUCATION PROJECT

How to Use this Guide

Thriving farms in the middle of the desert? Water from the salty sea? Or from thin air?! Though the State of Israel's natural water resources are limited, they've figured out a way to make the desert bloom. With the world's climate shifting and freshwater sources dwindling, there's never been a more critical time for all people to do their part in promoting a sustainable way of life. *Solving the World's Water Crisis: What Can We Do?* inspires us with real examples of what is possible, inviting us to learn from Israel's example, and to take action in our own backyards.

In this virtual exhibit, you will encounter a series of images and text that detail the innovative infrastructure, technology and people that made Israel a world leader in water security. This Educator's Guide offers facilitators additional resources with which to customize a program to the needs of their specific audience, timeframe, etc. For each of the ten topics covered in the exhibit, you'll find a **Guiding Question** to inspire further conversation and a **Connecting Activity** with opportunities to learn experientially and turn understanding into action. At the end, you'll find a **Bibliography** full of links to follow up on anything featured in the exhibit.

We can't wait for you to dive into this water exhibit - pun intended. Even more, we hope you'll share your findings. Post your ideas or photos of your work on social media using the hashtags #ConserveWater and tag us at @ISRAEL21c @RootOneTrips and help us grow our community of Jewish water stewards.

May all beings have access to safe, fresh water. Like Miriam in the Torah, who helped the Israelites to find water wherever they wandered, may we play a role in making it so.

Inroduction

Guiding Question

It's easy to underestimate water's role in modern life. We don't see water when we use a sheet of paper, for example, but buried inside that college-ruled loose leaf is the water it takes to grow trees, mill logs into pulp, bleach it and press it into sheets, make ink for the lines, etc. Scientists call this "embedded water," "virtual water," or a product's "water footprint." What are all the visible ways you might use water on an average day? Make a list, and then consider how water might be hidden inside things we do or buy. For example, it takes 115 gallons of water to produce one pound of apples. Where did all that water go? How might water be embedded in a shoe, or in your flight to Israel? And how might we save water (and the environment) just by buying or eating differently? Check out this short video to learn more, or try estimating a household's water footprint with this handy calculator.

Connecting Activity

Remember the water cycle? Rivers, lakes and underwater aquifers are recharged by rain. After rain falls, the droplets keep flowing down, eventually funneling into a body of water. This is called a "watershed." (This short video offers an animated explanation of how it works.) Can you recreate Israel's watershed? First, look at some topographic maps like this or this; that's a special map that shows the elevation of the land. Then, using a shoebox or a large tray as your base, mold Israel's topography into a long sheet of tin foil. If you want to get really ambitious, you might include Israel's geographical neighbors, too. Next, use a spray bottle to make it rain. Where does the water pool or run off? Imagine, how could water be captured and stored from those places, or brought from the places it pools to nourish the rest of the land? Share your work on social media with the hashtag #Israel21cWater and see what other teens are doing!

National Water Carrier,

the foundation of Israel's water resourcefulness

Guiding Question

It's no coincidence that Theodore Herzl included a plan for a comprehensive water-delivery system as part of his dream. Water has always played an important part in determining Israel's leadership. Before Levi Eshkol became Israel's 3rd Prime Minister (1963-69), he led Israel's national water company, Mekorot. Even Moses and Miriam had to make sure the Israelites had water while wandering through the desert! What might responsible water management have to do with leadership? Can you think of other examples where political leaders or whole societies took great care of their water resources - or neglected it? What are some ways you might step up to be a water leader in your community?

Connecting Activity

The National Water Carrier is a country-sized version of what you might find in your own home, town or city - a system of pipes and pumps. As long as water follows the path of gravity, it can flow through pipes without assistance. Once it has to move against gravity, however, like up a mountain or to that penthouse apartment, water needs a little help from a pumping station. Try it for yourself! Get a box of compostable bendy straws and stick one end inside another to make a long chain. Can you create a pipeline to transport water from a sink to a nearby toilet? Or from the Kinneret in your watershed model to the Negev desert? Where can gravity help you keep things flowing, and where might you need a pump (or a blast of breath) to help get the water moving?

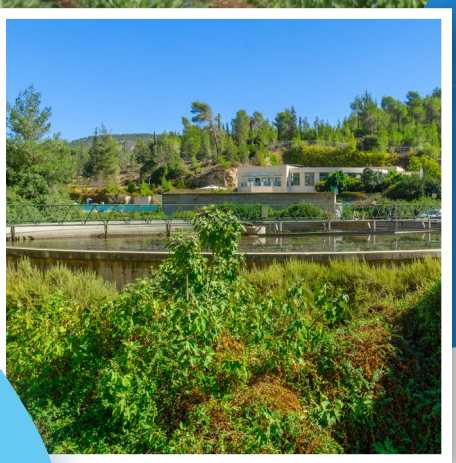
Drip Irrigation

Guiding Question

Drip technology is a fantastic example of how it's not always about doing more, but doing more with less. Can you think of examples in your own life, school, religious community or city where greater efficiency could help save time, energy or resources? What barriers might currently exist to making this system more efficient? Now start thinking like an Israeli start-up: what innovative new technologies or systems could lead to a positive shift?

Connecting Activity

Make your own drip irrigation system! Basic, DIY versions are super simple, and can be done for one plant or a whole garden. Check out this video time lapse of a drip irrigation made from a bottle of water and a string - perfect for watering that house plant while you're on vacation. More comprehensive systems often follow the same model: a central water source and lots of "strings" plastic piping branching out to cover each plant. Check out Netafim's contemporary catalog to get a sense of what components might be available, then sketch a plan for how you might install the system in your Temple's herb garden or the orchard of your dreams!



Wastewater and Stormwater Reclamation

Guiding Question

Does transforming your sewer's contents into clean water for agriculture or drinking seem to you like a fantasy or a nightmare? The research is clear: water recycling is safe. The technology has been around for a long time, and is already used in lots of places you might not expect, like Giants Stadium in San Francisco. But it can be hard for people to get over the "ick factor;" fearful advocates have often stalled or stopped these projects, raising scientifically inaccurate concerns about so-called "toilet to tap" technology. Hesitation is slowly giving way, however, as ongoing droughts increase water scarcity. If your city had the option of adopting advanced wastewater recycling, would you vote for it or against it? What information, endorsements, or proof might help you make up your mind? And how might you convince others of your position?

Connecting Activity

Rain is an important source of water that often goes to waste. Falling rain keeps falling until it finds an absorbent surface. With luck, that means soil. Otherwise, rain keeps running until it reaches the sewer, where it's either sent to a treatment plant for expensive processing, or diverted directly to water bodies - along with whatever litter, fertilizer, car oil, etc. it picks up along the way. You can help prevent this simply by growing more vegetation where there's already greenspace, placing potted plants outside, and doing your part to put trash where it belongs. Wanna turn the water collection up a notch? Install a device that allows you to harvest rainwater, and store it for watering plants on dry days! Check out this resource full of options - from barrels that install directly to a building's gutters to something you can build with just a trash can and some mesh.

Desalination

Guiding Question

Desalination is an imperfect solution: it solves the problem of not enough drinking water, but creates a problem of too much brackish water. In whack-a-mole style, we often put band-aids on problems that provide short-term fixes, but create more problems down the line. Truly resolving complex challenges like this one requires a "systems thinking" approach that considers how all things are interconnected, and how a change in any one place ripples out across the whole system. What other complex challenges can you think of in which "solutions" have also brought about unintended complications? For example, what if your school wanted to start a composting program? How would that affect the cafeteria workers or facilities staff? Where does the compost go, and who will take care of it? How are students going to be educated about what is compostable? Tricky problems can be solved! They just take careful solutions.

Connecting Activity

Desalination doesn't have to take place in a huge, industrial plant. You can do it on your kitchen counter! Simply mix up some saltwater, and pour an inch or two into a large bowl. Place a drinking cup in the middle of the bowl, and cover it with some plastic wrap or waxed paper. Add a small rock or weight on top so that the covering dips towards the cup. Place the whole thing in some sunlight and, in just a few hours, fresh water will condense onto the covering and drip into the cup, leaving the salt in the bowl. See this WikiHow article for step-by-step instructions.

Fixing the Leaks

Guiding Question

DrizzleX founder Esther Altura says: “Once you know how much you use, you use it differently. Most people do not want to waste water.” Do you agree? How might knowing how much water we use encourage us to use it differently? Some water utilities have successfully encouraged customers to use less water by ranking them on their bill - so folks know whether they were a star water-saver, consumed more than most, or ranked somewhere in the middle. Why do you think this approach might be successful? What other creative ideas might encourage water customers to not only know more, but also take action?

Connecting Activity

What’s the first step to solving a problem? Knowing that you have a problem. In other words, we can’t fix leaks until we can find them. Smart sensors may be the next wave, but you can check your home or community center for leaks using little more than your own five senses. Look for discoloration, bulging or cracks on walls or ceilings. Smell around for must or mold. Listen for drips or running water. Feel underneath sinks and fixtures with a napkin to gauge excess moisture. These suggestions and a few more can be found in this simple guide to detecting leaks. Make sure to ask permission before investigating, and to alert the appropriate person if any fixes might be needed.

Cooperative Efforts

Guiding Question

Do you think access to clean water is a basic human right? The United Nations General Assembly voted to recognize it as such in 2010. Unfortunately, that doesn't mean that the billions of people currently lacking access suddenly had a sink in their home. What's worse, over 40 countries, including the US, abstained from the vote. Why do you think this issue might be so complicated? If access to water is a human right, whose job is it to create the infrastructure needed, pay for the labor, and maintain the system? Where does the obligation begin and end - at the borders separating countries, or states, or is it all humanity's job to watch out for one another? But it's not just up to world leaders; what role might each of us play in ensuring that everyone has access to safe, clean water?

Connecting Activity

What if shared concern around water conservation and climate change could help bring people together? Israel is already strengthening regional bonds through sharing water resources, but EcoPeace Middle East dreams even bigger. Their plan, called the Green Blue Deal, calls for greater cooperation between Jordanian, Palestinian and Israeli neighbors in order to increase capacity for water resources, climate change adaptation, jobs, and more. They're calling on world leaders - and average citizens like us - to help create a "coalition of the willing" and generate demand for the possibility of peace. Check out their website to learn more, read through their plan and, if you agree, email or call your elected officials and encourage them to support implementation of the Green Blue Deal.

Innovative New Technologies

Guiding Question

Making water from the air and growing vegetables without soil may seem like a far-off future, but these technologies are being used today. Some people think that advanced systems like these will be necessary, especially as food and water resources grow more fragile from climate change. Skeptics favor a return to pre-industrial practices, encouraging the adoption of organic farming and Indigenous agricultural wisdom. Still others encourage a diverse range of solutions that can be customized to the situation. Where do you fall in this spectrum? What are some of the advantages and disadvantages of depending on technologically-advanced methods, or traditional practices?

Connecting Activity

One way to cut the carbon and water needed to grow food is to buy produce that's grown closer to home, decreasing the amount of packaging, refrigeration and transit required. As the demand for locally-grown food increases amongs city-dwellers, so do urban solutions such as farmer's markets, community gardens, vertical indoor farms, rooftop gardens, and more. Search the internet to find what options might be available near you, and take a field trip to see what's possible where you live. Want to get even more local? Try your own kitchen! Herbs, lettuces and even cherry tomatoes are easy to plant and grow happily indoors. Just poke a few drainage holes in the bottom of a used yogurt tub, add soil and seeds, and you're ready to go!

Where do I fit in?

Guiding Question

It is often said that, "the youth shall lead us." Are you ready? By now, you've learned a lot about water resource management - both the challenges and the opportunities. You also know that maintaining adequate supply takes a plan, strong leadership, and cooperation on local and global scales. So what would you do if you were in charge of ensuring access to clean water for your community, state or country? What would be the top priority on your list? How might you maximize the benefits to people, agriculture and wildlife, while mitigating harm wherever possible? What is the sustainable water future that you imagine?

Connecting Activity

Any change we wish to see in the world has to start with us, but it can be hard to follow through. Research shows that we're more likely to follow through on our commitments when we write them down, and even more likely when we share our aspirations with others. Take 5-10 minutes now to think, journal or draw about the water conservation topic that interests you the most. Is there a one-time action you could take that would help protect our water resources, or a small change you might make in your daily routine that could add up to big savings? Can you encourage others to make these changes, or combine your efforts with a group in order to advocate for bigger, systemic shifts? (If you're stuck for ideas, check out "The Lazy Person's Guide to Saving the World" in support of the UN Sustainable Development Goals, including SDG 6, Clean Water and Sanitation.)

Once you've thought it through, identify one idea for a positive change you can make starting today. Write down your commitment and share it with the group. Afterward, have fun getting photos of yourself doing the action(s), and share your pictures with the group as a way to encourage one another.

Ready to make the circle even bigger? Share your commitments and photos on social media. Use the hashtag #ConserveWater and tag @ISRAEL21c and @RootOneTrips to see what commitments other teens just like you are making!

Let's encourage each other to keep up the good work, until all people have access to clean water and a shared path to a sustainable future.

Bibliography

Introduction

"Water and the Global Climate Crisis: 10 Things You Should Know." *UNICEF.org*. Published March 18, 2021, updated March 17, 2022.

"Climate Change to Increase Water Stress in Many Parts of the US." Rebecca Lindsey, *NOAA / Climate.gov*. Published Nov 14, 2013, updated July 3, 2021.

National Water Carrier

"The Founding of Mekorot." *Mekorot: Israel National Water Co*.

"The National Water Carrier (Ha'Movil Ha'Artsi)." Shmuel Kantor, *University of Haifa*.

"The National Water Carrier's Jubilee." *Mekorot: Israel National Water Co*.

"Tahal." *Jewish Virtual Library*.

"Water in Israel: Historical & Technological Aspects in Development of Limited Water Resources." Dr. Dov Sitton, *Jewish Virtual Library*.

Drip Irrigation

"Acclimation of Methane Emissions from Rice Paddy Fields to Straw Addition." Yu Jiang, Haoyo Qian, Shan Huang, Xingyue Zhang, Ling Wang, Li Zhang, Mingxing Shen, Xiaoping Xiao Fu Chen, Hailin Zhang, Changying Lu, Chao Li, Jun Zhang, Aixing Deng, Kees Jan Van Groenigen, Weijian Zhang, *Science Advances*. Jan 16, 2019.

"Israel's Drip Irrigation Pioneers Aim to do Away with Flooded Rice Fields." Sue Surkes, *The Times of Israel*. Published May 10, 2021, updated May 16, 2021.

"The N-Drip Solution." N-Drip.

Netafim, Israeli website. Netafim, US website.

"PepsiCo and N-Drip Partner to Provide Water-Saving, Crop-Enhancing Benefits to Farmers Around the World." PepsiCO, Inc., *PR Newswire*. March 16, 2022.

"Water in Israel: Historical & Technological Aspects in Development of Limited Water Resources." Dr. Dov Sitton, *Jewish Virtual Library*.

Wastewater and Stormwater Reclamation

"10 Ways Israel's Water Expertise is Helping the World." Abigail Klein Leichman, *ISRAEL21c*. March 20, 2017.

"Chart: Globally, 70% of Freshwater is Used for Agriculture." Tariq Khokhar, *World Bank Blogs*. March 22, 2017.

"Green Israel News." *Keren Kayemeth LeIsrael-Jewish National Fund*.

"Israel Develops Water-Conscious Culture." Sheryl Harris, *Capital Press*. Published Feb 1, 2018, updated Dec 13, 2018.

"Israel Leads the Way in Wastewater Reuse." Cristina Novo, *Smart Water Magazine*. July 20, 2020.

"The Israel Water Story." *Sustainable Nation*. 2020.

"Israel's First Biofilter Launched in Kfar Saba." *Keren Kayemeth LeIsrael-Jewish National Fund*, Nov. 02, 2009.

"Tackling Water Scarcity: Israel's Wastewater Recycling as a Model for the World's Arid Lands?" Vivian Futran, *Global Water Forum*. March 18, 2023.

"Water Technologies." *Keren Kayemeth LeIsrael-Jewish National Fund*.

Desalination

"Alexander Zarchin." *Wikipedia*. Last edited Sept. 14, 2021

"Background - Seawater Desalination in Israel." *Israel Ministry of Finance*. Nov 9, 2020.

"Desalination in Israel and RSDS Project." Abraham Tenne, *Israel Water Authority*. Dec. 2018.

"Israeli Inventions: Desalination and Drought." The Wire, *The Jewish Federation of Greater Los Angeles*. April 18, 2016.

"Israel, Jordan Sign Huge UAE-Brokered Deal to Swap Solar Energy and Water." TOI Staff and AFP, *The Times of Israel*. Nov. 22, 2021.

"Seawater Quality at the Brine Discharge Site from Two Mega Size Seawater Reverse Osmosis Desalination Plants in Israel (Eastern Mediterranean)." Nurit Kress, Yaron Gertner, Efrat Shoham-Frider, *Water Research*. March 15, 2020.

Fixing the Leaks

"Finnish Utility Partners with TaKaDu to Detect Water Leaks." Rebecca Stadlen Amir, I*SRAEL21c*. July 2, 2018.

"How Israel Swims Against Tide of Worldwide Water Crisis." Abigail Klein Leichman, *ISRAEL21c*. Jan. 6, 2019.

"How Israel Used Desalination to Address its Water Shortage." Mark Weiss, *The Irish Times*. July 18, 2019.

"drizzleX." *drizzleX*.

"Israeli Tech Can Curb Water Waste in Multifamily Homes." Abigail Klein Leichman, *ISRAEL21c*. Nov. 19, 2019.

Cooperative Efforts

"The Abraham Accords." *US Department of State*.

"Center for Transboundary Water Management." *Arava Institute*.

"Israel, Jordan Sign Huge UAE-Brokered Deal to Swap Solar Energy and Water." TOI Staff and AFP, *The Times of Israel*. Nov. 22, 2021.

"Scoop: Israel, Jordan and UAE to Sign Deal for Huge Solar Farm." Barak David, *Axios*. Nov. 17, 2021.

Innovative New Technologies

"Agropolis: The Role of Urban Agriculture in Addressing Food Insecurity in Developing Cities." Milica Koscica, Journal of International Affairs. Spring / Summer 2014.

"Fancy a Glass of Drinking Water from your Car?" Abigail Klein Leichman, *ISRAEL21c*. Feb. 20, 2019.

"Future Food-Production Systems: Vertical Farming and Controlled-Environment Agriculture." Kurt Benke & Bruce Tomkins, Sustainability: Science, Practice and Policy. Nov. 20, 2017.

"How it Works." *Tal-Ya: Agriculture Solutions*. 2022.

"Urban Agriculture on the Roof of Dizengoff Center – Dizengoff Center." *Dizengof Center*. Sept. 22, 2015.

"Watergen Innovative GENius Technology." *Watergen*.

Where Do I Fit In?

"Israel, a Water Superpower, is Helping California Fight Drought." Ilana Curiel, *Ynetnews*. July 23, 2015.

"Needed: 11 Trillion Gallons to Replenish California Drought." Dr. Tony Phillips & Science@NASA. Dec. 16, 2014.