Walking on water

As vital as water is for our survival, we don't treat it very well. One man's odyssey to retrace and reduce his water footprint.

BY LARRY GALLAGHER

PHOTOGRAPH: FANCY PHOTOGRAPHY

UNTIL ARJEN HOEKSTRA COINED the term, one might reasonably consider Jesus to have been the only guy with a water footprint. Hoekstra, a professor of multidisciplinary water management at the University of Twente in the Netherlands, came up with the concept in 2002 as a way to highlight hidden aspects of water consumption.

While we are all more or less conscious of the water we put through our pipes at home, that is on average only about 10 percent of the water used on our behalf, or the water needed for the production and delivery of every good and service we consume. Not just food, clothing and shelter, but the things we *really* can't live without: smartphones, tablets and flat-screen TVs. In the U.S., the number is pegged at 750,000 gallons per person per year, which works out to about 2,050 gallons a day. In the Netherlands, that figure is 387,000, just above the global average of 365,000. Globally, the biggest draft goes into agriculture, which drinks up roughly 70 percent of the freshwater we use.

These numbers are crucial because there are too many spots around the globe where there is not enough of a clean, reliable supply to keep the land and people healthy. Once mighty rivers like the Colorado and the Yangtze are being sucked to a paltry trickle before they hit the sea. Ancient underground aquifers like the Ogallala, which underlies a good swath of America's heartland, are getting lower by the year. Once great lakes like the Aral Sea and Lake Chad are being systematically drained and turned into desert. Many of the world's poor have trouble getting the water they need to survive, not to mention the dubious quality of what they end up with. Existing supplies are being compromised by agricultural and industrial runoff. The recent discovery of a vast reservoir of groundwater in Africa is good news for that continent and might help Africans through tough times. But since the reservoir is a nonrenewable resource, the problem of water security—and the need for solutions—remains just as urgent.

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>
> **ARJEN HOEKSTRA, PROFESSOR OF MULTIDISCIPLINARY WATER MANAGEMENT**

The irony is, there is no actual shortage of water. Some 70 percent of the earth's surface is covered with the stuff; 97 percent of that is saltwater, 2 percent is locked up in the poles and in glaciers and 1 percent is all the freshwater circulating through the hydrological cycle. Except for any fluids astronauts happen to jettison in space, all that water stays here on the planet, in one form or another. So it's not the volume of H20 that makes the difference, but the quality, location and timing of its distribution—and the consequences that result when we affect any of the above.

There are many causes of this situation: overuse of flood irrigation, growing populations, failing infrastructure. And there is a simpler, albeit paradoxical, explanation for all the water we use: As vital as it is for our survival, we don't value it that much. So it is into the heart of this disconnect that I aimed my investigative odyssey: to comprehend and take responsibility for my share of the great river of water that flows through the world. In so doing, I found solutions in my own life, in the food that I buy, the energy I consume, and all the way back to the spigots in my own backyard.

Hoekstra and his associates at the Water Footprint Network (WFN) have set themselves a formidable task: to offer nations, corporations and individuals a set of tools with which to evaluate their direct or indirect water use and the effects of that consumption. On waterfootprint.org there are links to studies as well as some readily digestible statistics breaking consumption down by country and product. A cup of coffee takes 37 gallons of water to produce, for example; a bottle of beer takes 30, and a single sheet of paper takes 2.64. (For more water use stats, see "Can I have some water with that?" on page 66.)

What WaterFootprint.org doesn't contain are simple prescriptions for lowering our water footprints. "Simple messages are very attractive, but there are always catches," says Hoekstra. Water footprint averages are taken across widely ranging conditions: rainfall, soil types, climate and farming methods. Meat, especially beef, with all the grass and grain it takes to produce it, uses a huge amount of water. But, as Hoekstra points out, even this calculation is not so simple. If the cattle eat grass on a well-managed rangeland, fed mostly by rainfall, the numbers drop way down. Contrast that with heavily fertilized legumes grown with injudicious use of pesticides on irrigated land. "If you compare badly grown pulses with very well-produced beef, by a number of measures it is actually better for the planet for you to eat the beef," says Hoekstra. Corporations have come to the realization not only that they need water to keep their operations running, but that public perception of their water usage could seriously affect their bottom line. The most prominent example is Coca-Cola, which in 2004 was forced to close a bottling plant in the Indian state of Kerala because of protests over its use of local water supplies.

As a preemptive measure, a number of independent agencies are setting up voluntary programs that will allow corporations to disclose water usage in their production and, more important, their supply chains. The Carbon Disclosure Project is putting together a water adjunct, presumably so that corporations can be rewarded for improving their water usage. The Nature Conservancy is ramping up a similar program. Still, it will take some time before this information makes its way to the consumer in a comprehensible form.

A recent ad campaign by Levi Strauss illustrates some of the problems with existing approaches. In 2010, the company marketed a line of jeans called Water<Less, which they claimed used 11 gallons less water per pair in the stonewashing process. What they didn't mention was that it takes nearly 2,250 gallons just to grow the cotton for the pants, with the final tally closer to 3,000 gallons for the finished product. Nor would it likely boost sales if they mentioned that conventionally grown cotton is among the most heavily sprayed crops on the planet, using a staggering 30 percent of all pesticides while covering only 2.4 percent of cultivated land.

The rest of the world is still catching up with the WFN. In the meantime, for us end users the water footprint concept's usefulness may not be attached to individual products, but may be generally consciousness-raising. Knowing that we can't consume anything without consuming water offers another incentive to move beyond the culture of disposability. And as for the things we can't help consuming, the best guideline is to learn as much as we can about the food and fabric we buy and to buy the most consciously grown products we can afford. Having set that high standard for myself, I set off to see if it was remotely achievable.

If you had told me it was possible to power a dairy on cow manure befouled water, I would have said you were full of cow manure. But at the Straus dairy in Marshall, California, a shotgun blast east of the San Andreas Fault on Tomales Bay, they have been doing it for years. Every day they sluice dung from the milking barn downstream into a chain of ponds. In the first pond, much of the solid material is extracted with a giant screw, to be scattered on pastures as fertilizer. The liquid flows into a second pond covered with a great rubberized tarp. Anaerobic bacteria digest the remaining nutrients therein, producing methane, which feeds a generator that dumps electricity into the grid. This is enough power for not only the whole dairy, but also the electric Rav4 that Albert Straus uses to drive to the creamery every day.

But that water is not done yet. After the methane is extracted, it moves to a third pond to settle. Eventually, it is pumped through the generator to capture the waste heat and used once again to clean the barn—and the cycle continues over and over until, drop by drop, the water evaporates back into the air.

I made the hour-plus trip up from San Francisco to the dairy to witness this part of my water footprint. My wife and I are already consumers of Straus's organic yogurt, butter, cream and ice cream, although I admit when I am feeling out of pocket I

WATER GURU BROCK DOLMAN HAS CREATED A SYSTEM TO CAPTURE AND MAINTAIN RAINWATER LONG ENOUGH TO ENABLE THE SOIL AND PLANTS ON HIS LAND TO ABSORB IT.

PHOTOGRAPH: ISAAC HERNANDEZ/MERCURYPRESS.COM

opt for a slightly cheaper competitor. But I had read good things about Straus and water usage, and I wanted to see in person the ways Albert is stewarding water on my behalf.

"All my life, we have never had enough water," says the 61-year-old Straus, who converted the family farm to organic in 1994, started the creamery, and instituted the many innovations I have come to witness. He admits that local limitations on water supply have helped power innovation. But having little available water also gives him a good excuse to pursue a personal obsession of reducing the ecological footprint of his operation. Water use is even tighter at the Straus Family Creamery, six miles down the road, where the milk generated on this and three other affiliated dairies is processed into

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the product that I see in my grocery store. Straus moves about 9,500 gallons of milk a day through the creamery, which is small compared to modern mega-creameries. Still, they produce enough product to participate in markets in six neighboring states.

Due to logistical circumstances, the creamery is forced to truck in the water it uses for its day-to-day operations. Because of this, Straus has installed a number of systems, some of his own design, to clean and re-circulate 90 percent of the 10,000 gallons of water used daily for cleaning equipment. Capturing water from making condensed milk products alone nets him 3,000 to 4,000 gallons a day. The wastewater from the creamery is then trucked back to the farm, where it goes through the methane digester and back into circulation.

Standards for organic farming have been around long enough and have been codified in such a way that consumers can use their buying power to encourage farmers to do the right thing with land. But similar initiatives to encourage wiser water use are still nascent. A group called the California Institute for Rural Studies has included Straus among its California Water Stewards, alongside vineyards that are recycling water and others using dry-land farming techniques. On a larger stage, the Stockholm International Water Institute awards prizes each year to corporations and individuals working out enlightened solutions to world water issues. Albert Straus is not waiting for awards to catch up with him. When you meet him, it becomes apparent that he is not the PR engine promoting his dairy's alternative vision to the world. There is a quiet intensity to him, but nothing slick in his delivery. As he walks me around showing me the innovations he has initiated, you get a sense of the shy kid in your fifth-grade science class who builds a working steam engine in his garage.

I suggest perhaps he has hit the limit of how much productivity he can squeeze out of a gallon of water, but he'll have none of it. This year he has set up company-wide incentives to lower not only his water usage by another 20 percent, but also natural gas by 20 percent, and waste by 30 percent. Says Straus, "I'm not stopping."

ENERGY IS WATER; WATER IS ENER-gy. When you open the tap, out flows energy. When you turn on a light switch, you are burning water. In the industrial world, there is no separating the two. Nearly all the energy we use requires water to produce. And it takes energy to move, treat and pressurize the water we use.

Look at electricity. The U.S. Department of Energy estimates that 40 percent of freshwater withdrawals are used in thermo-electric power generation. Whether nuclear, coal-powered or thermal-electric, electricity generation involves the heating of a liquid to the boiling point, whereupon the steam energy drives some kind of generator. Once the steam has been used to drive the turbine, the liquid must be re-condensed before it loops back through the cycle. It is in this cooling phase that most of the water is used. And yes, varying with the cooling technologies employed, most of that water is returned to lakes or rivers, but not without environmental consequences.

Ditto petroleum products. The 800 million gallons refined each day in the U.S. consume two billion gallons of water, which works out to between 2 and 2.5 gallons of water for each gallon of gas. Bumping up our use of biofuels would only increase this number, to about 3.5 gallons for every gallon of ethanol or biodiesel. And anyone who has been paying attention to natural gas knows of the controversial technique of hydro-fracturing, aka fracking, which has been implicated in the contamination of groundwater supplies in many places in the U.S.

On the positive side, every water saving brings with it a diminution of carbon footprint, and every spared watt saves a drop of water. If you need another reason to get behind renewables such as wind and photovoltaic solar, here it is: Their water use is tiny compared to the others.

We have the most direct control over the water we use at home. Mitigating our home use helps mitigate our "hypocrisy footprint," which few of us are without. Information on how to minimize water use at home is easily found. Between water-efficient appliances, flow restrictors, low-flush toilets and conscientious use, most of us can easily cut our usage in half. For those who have already taken these measures, or for water conservation freaks like myself, there remain two paths for pushing the envelope: rainwater catchment and greywater.

Of all the ways to minimize one's water footprint, rainwater harvesting is the most fun, possibly because it doesn't require using *less* of anything. How much of your water usage you can minimize depends on the rainfall patterns where you live. The Mediterranean climate in San Francisco is actually among the worst for these purposes, since the city gets most of it water in half the year. In places with more even distribution of rain, you can move four to five gallons for every gallon of storage you have.

The general rule of thumb about catching rain is that you can get 60 gallons for every 100 square feet of footprint, per inch of rain. I set myself up with nine 60-gallon barrels, which waters my small vegetable garden for most of the summer. In addition, I installed a special 60-gallon tank on the exterior wall of the bathroom that will supply me with water for laundry throughout the rainy season. Since I will be constantly draining this tank over the rainy winter months, I figure I can put 1,200 gallons through this tank alone.

One of the unintended consequences of installing a rainwater catchment system is that you realize both how cheap water is and how much of it we use in our ordinary lives. For example, a study in Australia showed that when people started catching rainwater, their usage went down 20 percent to 30 percent, even discounting the water they put through their system. The best way to use this water is to send it via gravity feed to water landscaping, but in extreme climates it can be used as drinking water, with the right type of filtering to remove potential animal-borne parasites.

Do the math on the economics of rainwater catchment and you'll realize just how cheap water is. According to Robert Glennon in *Unquenchable*, the cost of water for the average homeowner in the U.S. is $2.50 for 1,000 gallons, or a quarter-cent per gallon. In Germany, those same 1,000 gallons would cost you $23, although you could get the same amount in Italy for more like $5. Even at the relatively exorbitant price of 2 cents a gallon (including the sewer fee), it will take me 23 years to break even on my investment. So a better way to rationalize my investment is that in the event of an earthquake, everyone will be coming to me for drinking water.

Then, of course, there is the fun factor, which you can't put any numbers on. When

THE SAHARA FOREST PROJECT COMPRISES GIGANTIC GREENHOUSES IN DESERT LOCATIONS THAT ENABLE THE PRODUCTION OF WATER, ENERGY AND FOOD.

ILLUSTRATION: EXPLORATION ARCHITECTURE

The technology of clouds

How do you create a cool, damp climate in a bone-dry desert?

CHARLIE PATON HAD AN IDEA WHILE ON A BUS RIDE THROUGH MOROCCO. AS PASSENGERS stepped in from the rain, the moist heat from their bodies hit the cool windows, forming condensation. Paton realized he couldn't make it rain, but he could create water wherever warm and cold air meet. He founded Seawater Greenhouses to do just that, setting up indoor farms in the stifling, arid heat of the Canary Islands, United Arab Emirates, Oman and Australia.

"As far as the eye can see, there are no houses," Paton says of Port Augusta's scrubby, deserted salt marches in the Australian Outback. Inside Seawater's first commercial greenhouse, though, the climate is humid, and bright red tomatoes are everywhere. The glass building is 1.5 miles from any kind of water. What it has in abundance, however, is warm air. When this warm air hits the greenhouse, it passes through a cool, honeycombed wall that desalinates it and funnels the condensation into an underground cistern. The room is cooled with the help of energy created by solar panels, providing an internal climate ideal for growing crops. The harvested water is used to nourish plants. And when the cooled air hits the back wall on its way out, it condenses again, releasing yet more water. The salt taken from the air is converted into sea salt for foods.

Paton's technique turns otherwise valueless land into prime agricultural plots. "If you've got tens or hundreds of acres of greenhouse," he says, "you'd be evaporating millions of tons of water."

This type of architecture can help heal other cracked landscapes. In Tenerife, where Paton successfully used the same techniques in the 1990s, the rocky landscape was once lined with trees, an ecosystem that naturally harvested water from the air, producing enough dew to form a wet haze. When the Spanish came through in the 15th century, though, they cut down the trees because the trees helped shield locals from attack. "The water stopped because the source of water wasn't rain," Paton says. "It was, in a sense, a cloud." Paton is bringing back the clouds. | **GREG T. SPIELBERG**

everyone around me is cursing in their galoshes, I'm catching pennies from heaven.

LAURA ALLEN NO LONGER REFERS TO herself as a guerrilla, but that doesn't mean the struggle is over or the war has been won. When Allen cofounded a group called the Guerrilla Greywater Girls in Oakland back in 1999, gray water was far enough out of the mainstream that just the act of disconnecting the runoff from a sink was already considered civilly disobedient, if not outright revolutionary.

The term applies to the waste that comes from sinks, showers and laundry. Contrast that with black water, which is what you flush downayour toilet, and you will get how the color scheme works. Back at the turn of the century, it was illegal in California for any wastewater to be routed anywhere but a city's sewer system or septic tank. But with the increasing strain on the water infrastructure, city and state officials are coming around to revising plumbing codes to allow redirection of certain drain waters for the watering of landscapes.

And so, with time, Allen and her associates changed their name to the less subversive Greywater Action, although her work remains essentially unchanged: teaching people how to extend the useful life of their drain water. I invited Allen over to do a graywater assessment on my house.

As Allen explains, using greywater responsibly is actually trickier than you might imagine. Though the dangers are arguably exaggerated, there are good reasons why municipalities don't want people hurling it out their windows, like in the Middle Ages, as it could theoretically be a vector for disease. Shower water and laundry water can contain small amounts of fecal coliform bacteria, basically via direct or indirect contact with your bottom. Sprinkled on lawns where children are playing or on vegetables that could be eaten raw … you get the idea. So the preferred route is to deliver the greywater slightly underground, where the vibrant flora in the top layers of soil quickly eat up any questionable bugs that come down the pipe with the water.

Another tricky thing about greywater is that you can't store it for more than 24 hours, as the resident bacteria quickly turn it into a skanky mess. Likewise, the solids contained therein will quickly clog the small holes in drip irrigation lines, and you don't want to be dumping the stuff on root vegetables or salad greens.

In a place like San Francisco, which dumps its treated wastewater back into the bay, the benefits of gray water are many. Every gallon used to irrigate plants is a gallon that doesn't have to be stolen from Yosemite snow runoff and pumped and treated, with the accompanying energy footprint. The plants sequester carbon and minimize the urban heat effect and, under the right circumstances, can even be used to grow food.

After surveying my situation, Allen recommends a "laundry to landscape" system, taking the outflow from the second story and sending it down to an infiltration bed in my front yard. We find a spot with partial sun where I can build a bed in which to plant a patch of raspberries, which love plenty of water. She tells me about a program sponsored by the San Francisco Public Utilities Commission subsidizing the conversion kits and offering a free class that will teach me how to hook it up, what kind of soaps to use, and what kind of plants like gray water.

I suggest that this collusion with the authorities further undermines her status as a guerrilla. She smiles with a twinkle in her eye, which suggests there are still many more boundaries to cross, and rides off on her bike to liberate another drainpipe.

All this reckoning of gallons is starting to tighten up my mind a little bit, fueling my natural predilection toward squirrel mind. So to broaden my sights, I hopped on my bike and made a trek north to sit at the feet of Brock Dolman, the resident water guru at the Occidental Arts and Ecology Center (OEAC), in the hills of western Sonoma County in California.

Dolman is a proponent of what he calls "conservation hydrology," an approach to water management that focuses on the level of the watershed, an area of land defined by the water that flows through it. Through his lectures and his consulting work, Dolman hopes to shift our collective perspective on water away from a commodity to be extracted from nature, and toward water as the lifeblood of the landscapes it inhabits. On the day I visit, he is in the middle of coteaching a two-week course on permaculture design, but he takes some of his downtime to walk me around the property and show me some of these principles in action.

PHOTOGRAPH: EDWINA PICKLES/THE NEW YORK TIMES/REDUX

THANKS TO A RAINWATER TANK, EMILY MURPHY OF QUEENSLAND IS ABLE TO WATER HER PLANTS. THE AUSTRALIAN GOVERNMENT SUBSIDIZES THE TANKS AS PART OF AN EFFORT TO FIND SOLUTIONS TO THE SERIOUS DROUGHTS PLAGUING THE COUNTRY.

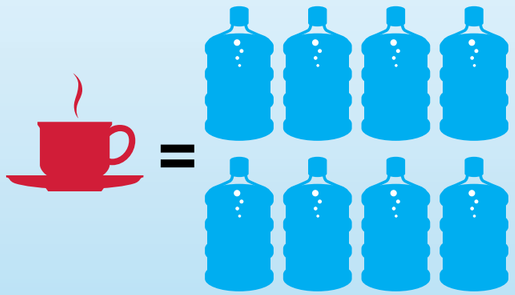
The standard approach to hydrology has evolved into a paradigm that Dolman, no small fan of alliteration, has coined "Pave it, pipe it, pollute it." He is talking about our tendency to cover the earth with impervious surfaces, like buildings and asphalt, which concentrate runoff in rainstorms and carry all the nasty stuff that falls off our cars downstream into rivers, lakes and oceans."Slow it, spread it, sink it" is the alliterative paradigm he coined to replace it. The idea is to do everything you can to keep the water around longer, to give the soil and the plants a chance to soak it up, filter it and let it recharge into aquifers right before it exits the watershed.

Dolman gives about 60 talks a year around the world to spread his message. Under the auspices of the Water Institute, he also acts as a consultant on many local and regional water projects, helping ranchers, farmers and environmentalists come together around gnarly water issues. It is while serving this last function that he often gets to play the role of the "eco-comedian," a sort of court jester whose foolery defuses the tension that can occur around community water issues.

He is a fearless perpetrator of the bad pun—"pun-ishment," as he puts it—delivered in a kind of deadpan that brings to mind a younger Bill Murray. When the severity of the situation calls for it, he has been known to show up to county hearings in a full foam-rubber Salmon outfit, offering testimony as the spirit of the Coho salmon before leaving

Can I have some water with that?

The actual water footprint of specific products can vary wildly according to location and methods of production, so these numbers should be considered loose averages.



Product/service	Gallons of water needed to make it
Cup of coffee (brewed)	37
Plastic water bottle	0.8
Avocado	42
1 lb. ground beef	1,581
1 lb. chicken	468
1 lb. turkey	286
1 regular pizza, 10-inches	312
1 pair leather shoes	2,113
1 wool sweater	594
1 queen-size mattress	2,878
1 queen-size cotton sheet	6,663
1 computer	10,556–42,267*
1 piece of paper	0.19
1 printer	9,510
1 television	3,900–65,500*
1,000 square feet synthetic carpeting	14,750
1 clothes dryer	16,909
1 side-by-side refrigerator	25,363

* = depending on type

SOURCE: THE GREEN BLUE BOOK *BY THOMAS M. KOSTIGEN*

Drinking from the sea

In an effort to provide their populations with enough drinking water, China and the Middle East are becoming global pioneers in desalination.

THE FIVE MILLION RESIDENTS OF THE Chinese city of Tianjin are well aware that there is plenty of water on the planet. After all, they live on the Bohai Sea, a large bay on the Yellow Sea in northeastern China. But ironically enough, a combination of drought, economic growth and huge water consumption has left the Tianjin city dwellers destitute, with just one-tenth of the water available to the average person worldwide. A brand-new desalination plant is meant to be their salvation. The Chinese authorities spent billions of dollars to construct the Beijing Power and Desalination Plant, where the residual warmth from a power facility is used to desalinate massive volumes of seawater.

The demand for desalination is on the rise in many parts of the world. According to Sabine Lattemann, a researcher in desalination at the University of Oldenburg in Germany, it is "the most promising way to create more clean water supplies." Of all the water on the planet, 97 percent is salty seawater. Desalination is increasingly applicable on a large scale, which makes it cheaper. "If you want clean drinking water, this is a cheaper and better alternative compared to bringing water over huge distances to places in need or building another large dam," Lattemann says.

Plants in the arid Middle East produce half the world's desalinated water. In Kuwait, for instance, 90 percent of the population is dependent on desalinated water. And in Saudi Arabia, the world's largest desalination plant, completed in 2010, supplies three million people with their drinking water. Construction of these plants is unstoppable, says Lattemann. China is one of the countries highly committed to this trend. This is not surprising, given that Tianjin is only one of 400 Chinese cities facing daily shortages of clean water.

Meanwhile, the rising number of desalination plants makes it important to study their environmental impact. "Desalination is a good thing, but you have to minimize energy use and the local impact on nature of building those plants," says Lattemann. After all, desalination uses a great deal of energy, especially plants that use the so-called thermal distillation process. This technique requires that water be heated to boiling point. Then the steam is captured in a cool area where it condenses into clean water droplets, while the salt remains behind in the boiler.

A modern variation on this process is reverse osmosis, in which membranes play a major role. These plastic filters with microscopically small pores allow water molecules to pass through, but not salt. This requires less energy because the water doesn't have to be heated.

Lattemann points out another important problem with desalination: the residual salt, which often contains chemical particles that cannot be tossed back into the sea. In the new plant in Tianjin, the salt is processed so that it can be used for other purposes. And revenues from the sale of the residual salt are sorely needed in Tianjin because the plant is still operating at a los.

But ultimately, China sees its investment in desalination as important to its future: it will help ensure that the country doesn't, quite literally, dry up. | **ELLEKE BAL**

A FISHERMAN CASTS HIS NET BESIDE THE BRAND-NEW DESALINATION PLANT IN CHINA'S TIANJIN, WHERE THE SUPPLY OF CLEAN DRINKING WATER IS DECREASING EVERY DAY.

PHOTOGRAPH: GILLES SABRIE/THE NEW YORK TIMES/REDUX

with a trail of orange Ping-Pong-ball spawn.

As we walk around the property, he shows me the many "micro-hydrological" projects that permaculture students and interns have carved into the landscape: strategically placed earthwork swales and berms and bumps that nudge water this way and keep it from picking up speed and scouring the soil on its way downhill. Over months, it will gradually leak through the land into the creeks that drain the area, keeping the creeks running year-round and aiding the return of the native salmon, one of the projects closest to Dolman's heart. "I'm just a freaky-assed little kid who was into catching snakes and got pissed at hominids who kept f***ing up my habitat," he says. "That's literally how I got here."

OAEC sits on an 80-acre piece of property about 50 miles north of San Francisco. Dolman and four other friends bought the land in 1994 and have turned it into a nexus of ecological education and activism. In the summer, demonstration gardens explode with flowers, vegetables and medicinals, lit up with the buzz of a million bees. They've got a new greenhouse in which they raise the starts they sell each week and a theater where they hold musical events for the community. The buildings and yurts, nomad's tents, serve as demonstrations of the low-impact technologies they espouse: solar hot water and natural building. Kiwi vines grow over trellises, forming natural gazebos. It's a kind of woolly paradise, retaining some traces of the hippie ethos that spawned it a generation ago.

While it is obvious how this type of landscape restoration helps this small niche of rural Sonoma County, I ask him what relevance this work has for the rest of us. He points to the Sun Valley Project in Los Angeles' San Fernando Valley as an example of conservation hydrology writ large.

For years, that part of the city has been subject to horrendous flooding. Instead of paying the Army Corps $60 million to create drainage ditches to shuttle the water into the Los Angeles River, a local nonprofit called Tree People came up with a plan to create a system of underground chambers that would buffer the water to both relieve the flooding and recharge the aquifers. Although the price tag was higher at $100 million, according to their calculations the city would make that extra bit back in 40 years, largely due to the decrease in water that they would have to suck out of the overtaxed Colorado River.

Dolman thinks the watershed approach to water management will become increasingly relevant with the increase in "global weirding," as he calls it.

Climate models and recent events predict that weather is going to swing harder in both directions: bigger floods and hurricanes in some places and intensified droughts and desertification in other places. Pakistan in 2010 is Dolman's favorite example of this trend: "They got three months' worth of monsoons in four days. Yet in the upland terraces, they were still in the midst of catastrophic drought."

The prudent way to buffer against future uncertainty, says Dolman, is to re-localize our relationship with the water that passes through our watersheds, to make better use of the water that we get, and to attempt to live within our "hydrological budget."

As I make my way back to the city, through the back roads of Sonoma County, I suddenly start noticing all the creeks draining that beautiful patch of earth. Salmon Creek, Ebabias Creek, Estero de San Antonio… one by one I pass them by at 15 miles an hour. I don't think I ever stopped to pay any mind to these living arteries, carrying life back and forth between land and sea. Maybe I've got water on the brain. Or maybe all this talk of watersheds has begun to alter my perspective on the land around me.

Either way, I will be thinking about water a lot more in the years to come—and, for better or for worse, I won't be alone. ■

IN THE SCOTTISH ECOVILLAGE FINDHORN, THE COMMUNITY'S WASTEWATER IS PURIFIED THROUGH A TREATMENT PROCESS THAT INVOLVES VARIOUS TANKS.

PHOTOGRAPH: MARTIN BOND/STILL PICTURES/THE IMAGE WORKS

Since 60 percent of **LARRY GALLAGHER** *is made of water, it can be said that water wrote this article about itself. The author took a similar approach to soil in our March 2010 issue.*