

## Thoughts on Water

Good morning.

I going to explore and share with you today some of our human concepts and understandings about one of the most ubiquitous chemicals on the planet – water. Strange and wonderful water. For such a small molecule...only 3 atoms, its influence over us is unmatched.

An Isosceles triangle balanced on its apex is an ancient symbol for flowing, falling water. It later became the symbol for water in alchemy. I would submit to you that it is a symbol that we should revive to represent that of the human-water relationship, a relationship that needs to be in balance.

Water is such a fundamental force in our lives that we have previously anthropomorphized it into goddesses and gods.

Ea, the Sumerian god of water, assigned the other gods their roles. He set the national boundaries.

Yemaya (YEE mah yah), the African goddess or “orisha” is the mother of waters and the protector of childbirth

Sebek, the Egyptian crocodile god, first came out of the waters of chaos to create the world.

Lady Precious Green, Chalchiuhtlicue (Chall wee tl'E kO), is the Aztec goddess of running water, springs, rivers & lakes. She is said to bring fertility to crops.

Boann, the Irish goddess of fertility, bounty and the River Boyne (Boyn Boin Jewish oy), and wife of the water god Elcmar (Elk mare), is known by her totem the sacred white cow.

Glaucos, the fisherman son of Poseidon & a mortal woman, and who also became a god, has a name that comes from the word for the silvery, greenish–grey or greenish-blue gleaming color effect that can be seen in the sea.

So why does water appear to us to be so powerful?

Water is a metaphor for life and it is actually the basis of life. We are born out of water, literally (amniotic fluid).

Life on Planet Earth is here because of water. Earth orbits in water's “sweet spot” a.k.a. The triple point. The triple point is the temperature and pressure range at which a substance can exist naturally in all 3 physical phases or forms (solid, liquid, gas)

We evolved to live in water's triple point/sweet spot.

Through the work of physicists, we know that water has a high specific heat, which means that water absorbs a great deal of energy before it changes form. Water absorbs the sun's heat during the day and releases it at night, thus buffering life from the extremes in temperature change

Pure water has a neutral pH denoted as 7 on that scale.

We know that water is attracted to other materials, and this property is called adhesion. Water's adhesive properties make it the “universal solvent”, which is to our benefit. It allows us to use water for cleaning and washing.

Ritual washing is a part of every religion.

Water is a metaphor for death and it brings death and destruction in many different ways. Water erodes. Water scours. Water drowns. We cross over the River Styx into death. We are buried in the floods. We are fearful of the deeps.

Psalm 69: verses 1-2 read: “Save me, O God! For the waters have come up to my neck. I sink in deep mire, where there is no foothold; I have come into deep waters, and the flood sweeps over me.”

Drowning in floods is the second most common cause of weather related deaths.

Hyper-hydration a.k.a. water poisoning or water intoxication results when the normal balance of electrolytes in the body is pushed outside of safe limits by over-consumption of water (drinking contests) or heavy exercise during which lots of fluids are consumed without replenishing the electrolytes.

Before the advent of drinking water disinfection, dysentery, a water borne disease, was the number three killer in the USA. It still is a dangerous killer in many parts our world.

Human use of water results in its contamination and fouling with salts, metals, sediments, nutrients, disease pathogens, as well as contaminants of emerging concern which are pharmaceuticals & personal care products and their degraded byproducts. We don't yet fully understand all the interactions in our environment and in us of much of the stuff on that list..

Water has been the battled over.

Samuel Clemons (Mark Twain) said, “Whiskey is for drinking. Water is for fighting.” because he lived at the point in the history of the American west which was full of such battles.

Abraham and Lot quarreled over a well.

Today, with more than 260 of the world's river basins being shared by 2 or more countries, we're in the position to launch wars over water.

Water as a chemical is fascinating, and, as I pointed out previously, it's such a small molecule. As simple as water is, its chemical and physical actions/reactions are not yet fully understood. We know that water is a polarized molecule. The 2 hydrogen atoms and 1 oxygen atom share electrons in such a way that the hydrogen end of the molecule carries a positive charge while the oxygen carries a negative charge.

The result is that water is highly cohesive. In other words, water is attracted to water.

Water's ability to form strong hydrogen bonds is surpassed only by hydrogen fluoride.

The oxygen atom's attraction to the bonding electrons of the hydrogen atoms which give the hydrogen nucleus a strong positive charge that is then attracted by the 2 sets of lone pair electrons on the oxygen atom creates a quasi-lattice structure of water molecules that is present even when water is in its liquid phase.

\*whew. What a mouth full. But all you need to know about it is that water's cohesive and adhesive properties allows it to be the work horse of nature, carrying substances in and out of all living things.

There are around 326,000,000 cubic miles of water on Earth. All the water that ever was is still here for water is difficult to create and to destroy. Oceans contain most of the planet's water, 317,000,000 cubic miles or 97.24% of all available water. Icecaps and Glaciers represent 7,000,000 cubic miles or 2.14% of water. Then, in this tiny green looking sliver is all the rest of the water.

Ground water	2,000,000 cubic miles	0.61% or barely more than ½ of 1%
Fresh-water lakes	30,000 cubic miles	0.009%
Inland seas	25,000 cubic miles	0.008%
Soil moisture	16,000 cubic miles	0.005%
Atmosphere	3,100 cubic miles	0.001%
Rivers	300 cubic miles	0.0001%

Change slide

So, fresh water, the water we denizens of land need, and in the form that we need it (rivers, stream, aquifer) is less than 1% of all the water available on the planet. To make matters worse it is unevenly distributed around the globe. Weather, the prime source of fresh water, is erratic.

Example: Wichita in 1966 received 12.17 inches of precipitation

Wichita in 2008 received 53.82 inches of rain.

Canals, aqueducts, qanats, pipes, lakes, reservoirs, tanks, cisterns, pumps...a.k.a. infrastructure to store and transport water is materially expensive and carries its own environmental costs...i.e. electricity for pumps to move water results in air pollution.

Altering the ecology of rivers with dams changes its water chemistry and its biological communities.

Hooking two biologically different river ecosystems together with canals can bring about the movement of invasive species with the loss of economically important species.

Taking water from one area to give it to another may cause the reduction of water available for farming or for maintaining ecological diversity, & etc.

And, here again is that big bug-a-boo of fresh water, we have to share it.

Have you ever considered, really truly given thought to how much water is required for the process of our daily lives? I've listed some here.

By 2025, 1.8 billion people will be living in areas with absolute water scarcity. Since 1900, half of the world's wetlands (a principal source of freshwater and a major natural method for cleaning water) have been lost. –Source: United Nations World Water Day 2009

- ⊙ Americans use 5 times as much water per person as that which western Europeans use
- ⊙ Food production requires 70% of available fresh water
- ⊙ Water needs of developing countries will increase 50% by 2025
- ⊙ Less than 1% of the water treated by public water systems is used for drinking and cooking
- ⊙ Groundwater, in many places a non-renewable resource, serves 80% of the planet's population
- ⊙ It takes 120 gallons of water to produce one egg
- ⊙ One can of fruit or vegetables requires 9.3 gallons for processing
- ⊙ 39,000 gallons of water goes into production of one new car

I could overwhelm you with facts and figures, but I think you are already aware that there is a problem brewing (all puns intended) with our planet's water.

The title of this slide is a double entendre.

A solution is created when another substance is dissolved, that is its molecules are separated from each other, each becoming surrounded by the molecules of another substance. Water, because of its polar bonds, dissolves many things making it an excellent solvent.

A solution is also the action or process of fixing or answering or explaining a problem.

The word solution comes from the Latin word *solvere*, meaning “to loosen, to release, to part.”

What are the most important uses of water?

Is water a human right?

Is water an economic good?

Is water a planetary phenomenon with legal standing for its existence & natural processes?

I don't have the answers for these questions. I pose them because I believe that our attitudes and beliefs about water need to be considered and perhaps changed.

With this slide I'm playing a riff on that popular "carbon footprint" idea.

The truth is your water footprint is as important as your carbon footprint. It may even be more important.

So, how will you alter your water footprint? Here are some ideas...

North Americans are mostly the only ones on the planet who insist on living in park lands and watering these excessively.

What if we turned most of our home landscapes into food gardens?

Do we need to wash things or ourselves as often as we do? (How many times can an item of clothing be worn before being washed? Is it necessary to shower every day or will a sink bath for a few critical body parts suffice?)

Food production uses an incredible amount of water. When was the last time you went dumpster diving? (How can we end the food waste that goes on around us?)

Can you turn that thermostat up a bit in the summer or down a bit in the winter? Energy production uses water. Hydroelectric dams and now wave energy generation projects that harness the energy of ocean tides alter ecosystems. Steam electric generation and nuclear electric generation all uses water for cooling which adds to the heat burden of the planet. (Have you considered how your energy use affects water?)

Will you change your transportation methods and habits? (It takes 1,850 gallons of water to refine one barrel of crude oil.)

We are the agents of change. To quote Margaret Mead, "A small group of thoughtful people could change the world. Indeed, it's the only thing that ever has." I really believe that, so in spite of having long considered myself to be a pessimist, perhaps I'm an incurable optimist.

Thank you for listening.

Kay Drennen