

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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Rainfall, Runoff, and Reservoirs

Santa Cruz is one of the few counties in Central or Southern California that are hydrologically self-sufficient - we don't import water through pipelines or tunnels as do many of the other counties from the San Francisco Bay area to San Diego. Well, unless you count all of the bottled water: Perrier, Fiji, Dasani, Nestle, Mountain Valley, Evian, Aquafina, or any of the other dozens of different brands of bottled water that get trucked over Highway 17.

Other than what comes out of those plastic bottles, we get our water in Santa Cruz County from either what flows across the land surface, or what resides beneath the ground. These two sources globally only make up 1.7% of all of the water on the planet, and all of the water in either place, streams or groundwater, started out in the ocean as salt water, days or decades before.

Evaporation from the ocean produces fresh water vapor, and on occasion, at least historically, that vapor rises and condenses to fall as precipitation across the county. That rainfall is not distributed uniformly, however, due in large part due to the effects of the Santa Cruz Mountains. As the rain clouds move over the mountains from the coast, they rise, cool, and the moisture condenses. We can therefore expect greater rainfall at higher elevations. Along the coast, for example, Davenport, Santa Cruz, Soquel, and Aptos average between about 26 and 29 inches of rain per year. Empire Grade and Boulder Creek, on the other hand, typically get closer to 60 inches.

The effect of topography on rainfall is particularly pronounced in two places on Earth that between them hold many of the world's rainfall records. La Reunion, a small Indian Ocean island near Madagascar, is circular in shape with lowlands near the coast but with central peaks reaching over 10,000 feet in elevation. The island lies directly in the path of southwest Indian Ocean tropical cyclones. Among many rainfall intensity records, it has received up to 45 inches of rain in 12 hours, and 71.8 inches of rain (six feet) in 24 hours. That's over twice our entire annual rainfall in just 24 hours!

The other area with stacks of rainfall records is the town of Cherrapunji, India, known as the wettest place on Earth. Monsoon clouds from the Bay of Bengal move inland and run smack into the foothills of the Himalayas, dropping all of that water on Cherrapunji. This damp little town holds the record for one month with 31 feet of rain, two months with 42 feet of rain, and a year with 87 feet of rain. They don't generally have water shortages in Cherrapunji, nor do they often leave home without their umbrellas.

When the rain hits the ground anywhere, it basically has two choices. Where the land surface is relatively flat and the soils are permeable, the water can infiltrate or percolate into the subsurface, eventually becoming part of the groundwater system. Where the land surface has more of a slope and/or where the ground is less permeable, perhaps because of bedrock close to the surface, compacted or saturated soils, or the presence of impermeable surfaces like roofs, streets, or parking lots, the water will run off and soon enters a waterway, creek or a stream.

For steep, relatively short watersheds like those of Santa Cruz County (the San Lorenzo River or Soquel Creek, for example), the total time elapsed from when a raindrop hits the ground surface to when that same water drop has flowed the length of the watershed (about 30 miles) and reaches the ocean may only be a day or two. The Amazon River, in contrast, is 4000 miles long, and the time from rainfall to ocean discharge can be weeks.

The City of Santa Cruz water supply system is about 96% dependent on surface water, with stream flow under natural conditions varying seasonally. The great bulk of our rainfall and runoff occurs between November and April, as is the case for much of the west where rainfall dominates over snowfall. This is why the development of the arid southwestern states, and we can count much of California in that category, was accomplished by either damming rivers and creating reservoirs to store that winter runoff, or by diverting or stealing water from someplace that had more of it.

Santa Cruz has only one large reservoir, Loch Lomond, on Newell Creek, near Lompico. The earthfill dam was completed in 1960 and the reservoir has historically provided about 24% of the supply to the city water system.