California Drought Update

For January 12, 2017

by Patrick Ruckert

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http://www.californiadroughtupdate.org

https://www.facebook.com/CaliforniaDroughtUpdate

patruckert@hotmail.com

When we are inclined to take these wonders for granted, let us remember that only a generation or two ago all the great rivers of America, the Missouri, the Columbia, the Mississippi, the Tennessee, ran to the sea unharnessed and unchecked. Their power was wasted. Their economic benefits were sparse. And their flooding caused an appalling destruction of life and property... this nation began to develop its rivers systematically, to conserve its soil and water, and to channel the destructive force of these great rivers into light and peace. And today, as a result of this, the face of this nation has been changed. Forests are growing where there was once dirt and waste. Now there is prosperity where our poorest citizens once lived If there is one outstanding story among all this which indicates the kind of progress we can make working together, it's the story of the REA... (the REA was the Rural Electric Administration, signed into law by Franklin D. Roosevelt in 1936. In that year only 10 percent of the farms in the country had electricity. Through the REA, by 1952, 90 percent of the farms had electricity).

President John F. Kennedy
Oahe Dam, August 17, 1962

A Note To Readers

And the skies opened up; rain and snow poured down upon the Earth; the people rejoiced.

At least that appears what the past week has been like. Yes, as reported, the drought has ended in the northern part of the state, or at least the reservoirs are full. Officially, 40 percent of the state is now out of drought, but that still leaves 60 percent in drought, and that part being where most of the population lives. The U.S. Drought Monitor's discussion goes into the details.

In addition, as reported below, the aquifers will not recover for years, if not decades, from the intense use of groundwater that has occurred over the past few years.

So, what is the weather phenomenon we have experienced the last couple of weeks? Atmospheric Rivers, which is discussed below. Ben Deniston of the LaRouche PAC Science Team, discussed atmospheric rivers in his 2015 discussion of how to solve, long-term, the ongoing water problem in the West: **New Perspectives on the Western Water Crisis** https://larouchepac.com/20150401/new-perspectives-western-water-crisis.

Perhaps the worst of the drought is over, perhaps not. But, as I reported last week, maybe we have entered a new climatic period, or rather, returned to the dominant climate of the past 2,000 years: Alternating mega-droughts and mega-floods. To give you an idea of the nature of mega-floods , here is a short excerpt from the item I mentioned last week. And, not surprising, atmospheric rivers play the central role.

California Megaflood: Lessons from a Forgotten Catastrophe

A 43-day storm that began in December 1861 put central and southern California underwater for up to six months, and it could happen again

By B. Lynn Ingram

https://www.scientificamerican.com/article/atmospheric-rivers-california-megaflood-lessons-from-forgotten-catastrophe/

Excerpts:

Geologic evidence shows that truly massive floods, caused by rainfall alone, have occurred in California every 100 to 200 years. Such floods are likely caused by atmospheric rivers: narrow bands of water vapor about a mile above the ocean that extend for thousands of kilometers.

he atmospheric river storms featured in a January 2013 article in Scientific American that I co-wrote with Michael Dettinger, The Coming Megafloods, are responsible for most of the largest historical floods in many western states. The only megaflood to strike the American West in recent history occurred during the winter of 1861-62. California bore the brunt of the damage. This disaster turned enormous regions of the state into inland seas for months, and took thousands of human lives. The costs were devastating: one quarter of California's economy was destroyed, forcing the state into bankruptcy.

In 1861, farmers and ranchers were praying for rain after two exceptionally dry decades. In December their prayers were answered with a vengeance, as a series of monstrous Pacific storms slammed—one after another—into the West coast of North America, from Mexico to Canada. The storms produced the most violent flooding residents had ever seen, before or since.

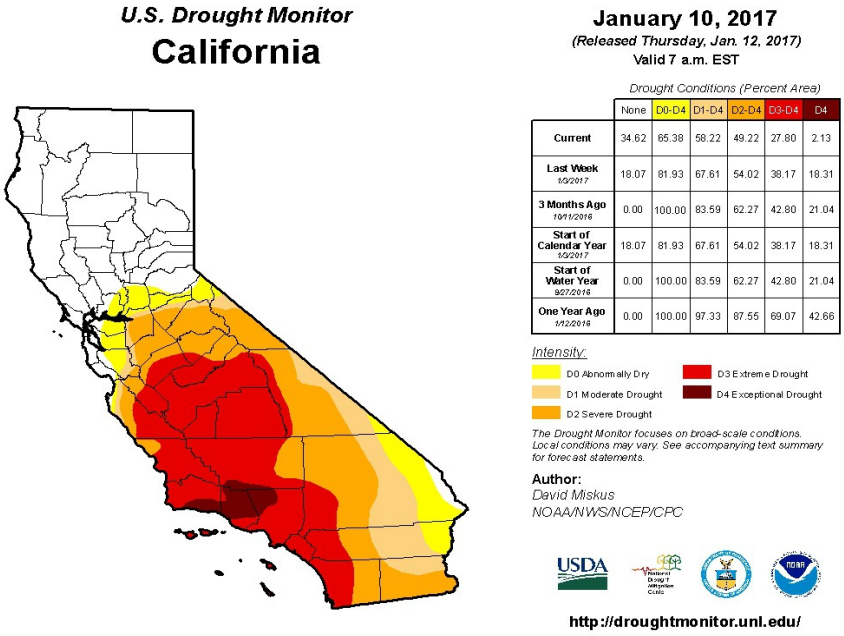
Sixty-six inches of rain fell in Los Angeles that year, more than four times the normal annual amount, causing rivers to surge over their banks, spreading muddy water for miles across the arid landscape. Large brown lakes formed on the normally dry plains between Los Angeles and the Pacific Ocean, even covering vast areas of the Mojave Desert. In and around Anaheim, , flooding of the Santa Ana River created an inland sea four feet deep, stretching up to four miles from the river and lasting four weeks.

This week's Feature continues the discussion of infrastructure, or better said, raising the productive power of the economy by moving to a new, higher platform of the productive process through the transformative power of more advanced technology. Next week we will discuss those technologies, or

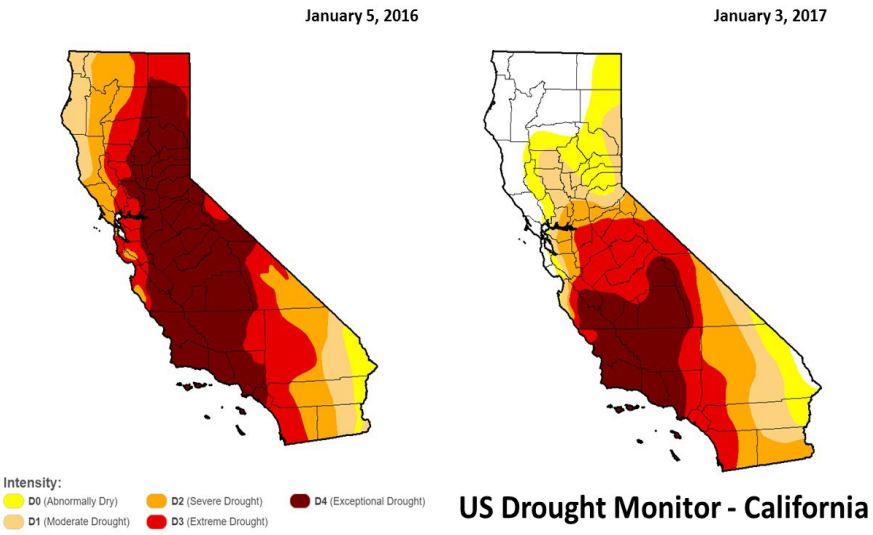
policies-- an expanded fusion research program and an expanded space program.

U.S. Drought Monitor and Reservoir Conditions

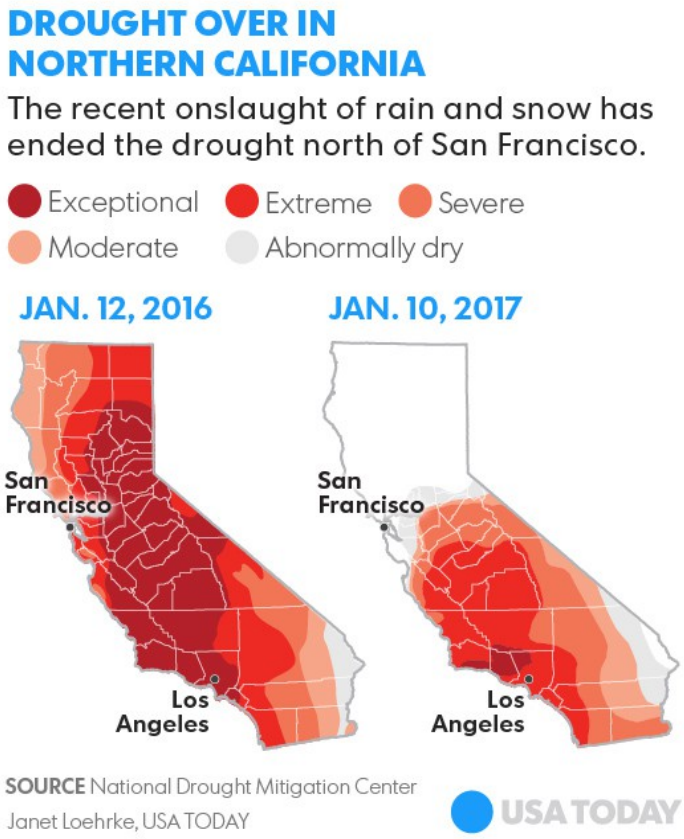
Whoa! What a difference a week makes! The portion of the state in drought dropped from 67 percent to 58 percent, and the real shocker is the drop of the portion of the state in "exceptional drought" from 18 percent to 2 percent. One year ago 97 percent of the state was in drought. The U.S. Drought Monitor presents the picture.



Here is the Drought Monitor from one year ago side by side with this year's January 3 map:



And here is a slightly different view of the same map.



The following is excerpted from the "Summary" accompanying the U.S. Drought Monitor map of January 10, which also introduces the Reservoir Conditions map below:

A plethora of Pacific storms and moisture slammed into California and most of the West, dumping copious amounts of precipitation on the northern two-thirds of the state and Sierra Nevada. This very wet week maintained the great start to the Water Year (since Oct. 1) across the West where NRCS SNOTEL basin average precipitation was above or much above normal at nearly every major basin while basin average snow water content was at or above normal in most Western basins. With more than a foot of precipitation falling on the Sierra Nevada (locally 20.7 inches at Strawberry Valley, CA), most major reservoirs were at or above its Jan. 10 historical average, USGS monitored streams were at near or record high flows, Jan. 10 state snow water content was at 135%, and the Northern Sierra 8-station, San Joaquin 5-station, and Tulare Basin 6-station precipitation indices topped their wettest previous year as of Jan. 10.

There were a few areas in southern California, however, that have yet to receive a bountiful Water Year and see any hydrologic improvements, so no changes were made there.

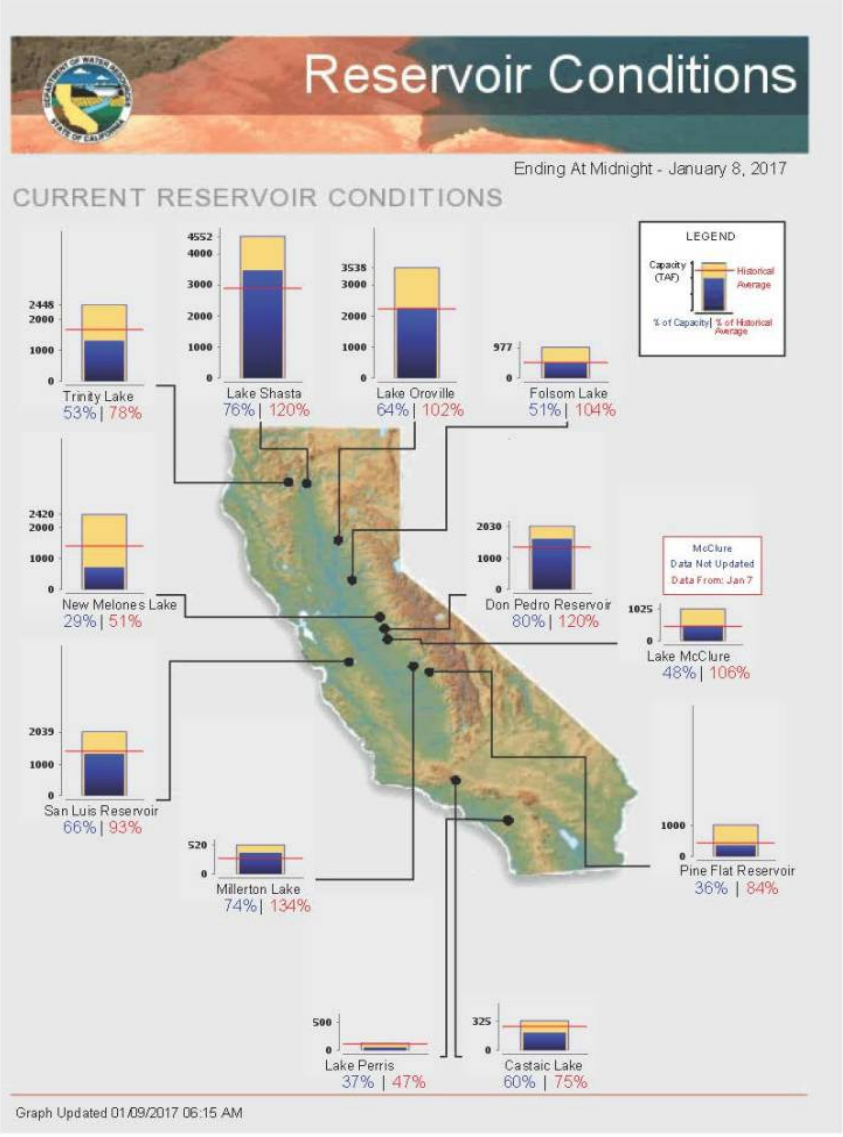
With more than 2 inches of precipitation falling from southwestern Washington southward to Los Angeles, CA, including over a foot along the northern and central California coast and on the Sierra Nevada range, significant increases were made to the capacity of the state's major reservoirs as most were above the normal Jan. 10 historic levels and still filling with most USGS monitored streams at near or at record high flows. The state's Sierra snow water content (SWC) was also well above its Jan. 10 normal, with the north (13.5", or 111%), central (16.9", or 130%), and south (17.9", or 171%)

producing a state average of 16.2", or 135%. The Northern Sierra, San Joaquin, and Tulare basin station precipitation indices all exceeded their wettest year (1982-83; 1968-69 for Tulare) as of January 10 with 41.9 (203%), 30.8" (199%), and 20.0 (190%) inches, respectively. In fact, the Northern Sierra index gained 13.2 inches since Jan. 1, or 26% of its ANNUAL average in 10 days.

Oroville Reservoir started the New Year with a deficit in its conservation pool of 750,000 acre-feet, but has gained 350,000 acre-feet in the past 2 days.

The past week's storms doubled the snowpack in parts of the Sierras. Recall that 30 percent of the water Californians use comes from the melting snowpack in the summer and fall.

Here is the reservoir map for January 8:



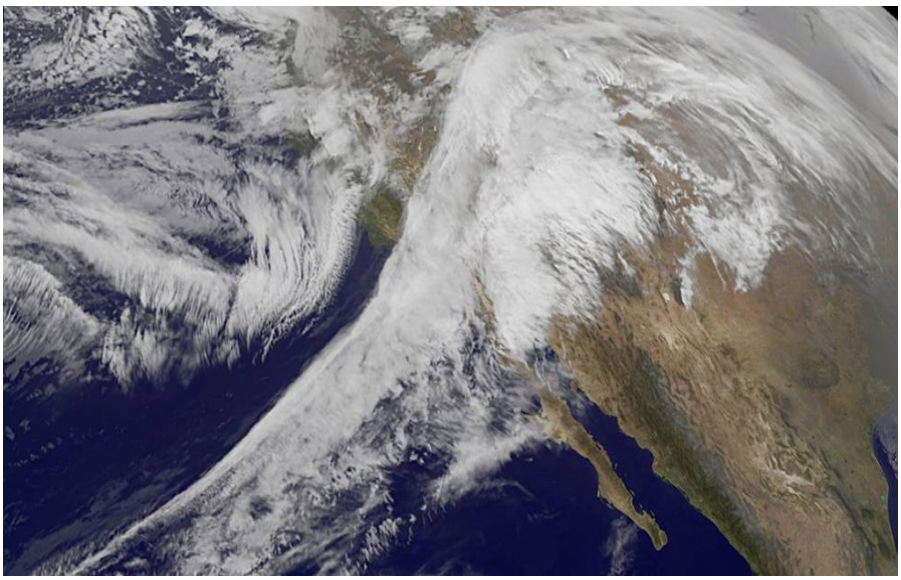
Note: Even San Luis Reservoir is at 93 percent of the average for this date. Lake Paris and Castaic Lake are still below normal, but that is because water from the California State Aqueduct has not yet flowed south to Southern California.

What the Storms Looked Like From Space

Terrible splendor: NASA captures Iras snowstorm from space in amazing animation

9 Jan, 2017
https://www.rt.com/usa/373144-nasa-iras-storm-space/

Here is the You Tube video:
https://www.youtube.com/watch?v=65OSNZArvlg



© NASA / NOAA GOES Project

While the weather outside may be frightful – the western US is freezing under several feet of snow from the lashing of Winter Storm Iras and other weather troubles to come – the view from space is quite delightful.

The satellite animation of visible and infrared imagery, captured by NASA/NOAA's GOES project, shows a powerful rhythmic storm of snow undulating across the Pacific Ocean driving across to the Pacific Northwest to blanket the region in snow. As the storm moves across the Pacifica Ocean a low pressure area is seen churning in a playful anti-clockwise eddy off Canada's west coast.

Atmospheric Rivers

The storms that have hit the state over the last few weeks are products of 'atmospheric rivers,' which usually deliver more than 50 percent of the precipitation that the state receives each winter, with between three to five of these rivers hitting the state. During the past five years of drought they have largely been missing. So far this winter there has been one after the another arriving, producing the record and near-record rain and snowfall so far experienced. These storms do deliver a lot of water, as the following excerpted article states:

California storms add 350 billion gallons to parched reservoirs

By Paul Rogers

San Jose Mercury News

January 9, 2017

http://www.mercurynews.com/2017/01/09/california-storms-fill-drought-parched-reservoirs/

The powerful storms that soaked Northern California over the past week did more than trigger power outages, mudslides and flash floods.

They sent roughly 350 billion gallons of water pouring into California's biggest reservoirs — boosting their storage to levels not seen in years, forcing dam operators to release water to reduce flood risks and all but ending the five-year drought across much of Northern California, even though it remains in the south, experts said Monday.

My comment: 350 billion gallons is equivalent to more than one million acre-feet of water. That is more than the capacity of Folsom Dam and Lake.

Here is an excerpted that gives some background on atmospheric rivers:

'Atmospheric rivers' weather phenomenon soaks California

By JOHN ANTCZAK
Associated Press

January 10, 2017

http://hosted.ap.org/dynamic/stories/U/US_CALIFORNIA_STORMS_QA?SITE=AP&SECTION=HOME&TEMPLATE=DEFAULT

LOS ANGELES (AP) -- They're called "atmospheric rivers" and they can dump massive quantities of Pacific Ocean water on California, carrying it through the air from as far away as Hawaii.

Here's a look at the weather phenomenon that has swelled the state's rivers, flooded vineyards, dumped snow and rain on the Sierra Nevada and raised the risk of mudslides on hills scorched by last summer's wildfires.

WHAT IS AN ATMOSPHERIC RIVER?

Atmospheric rivers are long and narrow bands of water vapor that form over an ocean and flow through the sky.

They occur globally but are especially significant on the West Coast of the United States, where they create 30 percent to 50 percent of annual precipitation and are linked to water supply and problems such as flooding and mudslides, according to the National Oceanic and Atmospheric Administration.

Formed by winds associated with cyclones, atmospheric rivers typically range from 250 miles to 375 miles in width and move beneath the influencing effects of other weather.

Most atmospheric river events are weak. But the powerful ones can transport an amount of water vapor equal to 15 times the average flow of water that flows out of the Mississippi River's mouth, according to NOAA's Earth System Research Laboratory.

WHAT HAPPENS WHEN AN ATMOSPHERIC RIVER REACHES LAND?

When the moisture-laden air moves over mountain ranges like the Sierra Nevada along the California-

Nevada border, the water vapor rises and cools, becoming heavy precipitation that falls as rain or snow, according to NOAA.

While traditional cold winter storms out of the north Pacific build Sierra snowpack vital to the state's water supply, Patzert said atmospheric rivers tend to be warm.

That causes the snow at the highest elevations but rain usually falls on the snowpack at lower elevations. That can quickly prompt melting, runoff and flooding and decrease the snowpack needed to supply California with water.

But, there are negatives along with the deluge. Not only floods, but the atmospheric rivers are usually accompanied by warmer temperatures. Two articles discuss this, both excerpts:

California's Huge Storm Could Cause Disastrous Melting in the Mountains

By Nick Stockton

January 5, 2017

https://www.wired.com/2017/01/californias-huge-storm-cause-disastrous-melting-mountains/

An atmospheric river's temperature is a major determinant to the ratio of harm to good it does. Cooler storms bring snow. Those that deliver rain are more complex, especially if the rain falls on pre-existing snow—like the storm coming this weekend will. If close to freezing, the rain might compress the existing snowpack, condensing powder into denser crud. "The rain can also trickle through the snow, or it can run right off the top and into a stream," says Anderson. Warm enough rain will melt some of the snow.

And too much warm rain could be disastrous. Snow is salvation against the periodic droughts that parch California. With a thorough winter packing, the mountains can hold much more moisture than all the state's lakes and reservoirs combined. In fact, those lakes and reservoirs are quite finite, which is why it is so important that any snow that falls during the winter stays frozen until summer. Otherwise, any melt that can't fit in the engineered storage systems gets released down the rivers, into the sea.

Flooding and snow melt are more likely when intense weather systems come in quick succession.

California's Snow Is Turning to Rain

Jan 5, 2017 2:07 PM EST
By Justin Fox
https://www.bloomberg.com/view/articles/2017-01-05/california-s-snow-is-turning-to-rain

Atmospheric rivers are thus utterly essential to the state's survival. But, coming from the tropics, they do have this annoying tendency to be kind of … warm. From the National Aeronautics and Space Administration, last spring:

> *A new study by NASA and several partners has found that in California's Sierra Nevada, atmospheric river storms are two-and-a-half times more likely than other types of winter storms to result in destructive "rain-on-snow" events, where rain falls on existing snowpack. Those events increase flood risks in winter and reduce water availability the following summer.*

Don't Forget the Groundwater

Five years of drought has forced a much heavier reliance on aquifers for both farmers and cities. Thirty percent of the state's water supply in normal years comes from the aquifers, and during drought that has gone up to more than 60 percent. During this drought, the aquifers have been serious drained, and will take years, if not decades, for them to recover.

Here are a couple of articles, excerpted, addressing the groundwater question.

Is California still in a drought as of January 2017?

By John Buginas

January 9, 2017

https://www.quora.com/Is-California-still-in-a-drought-as-of-January-2017

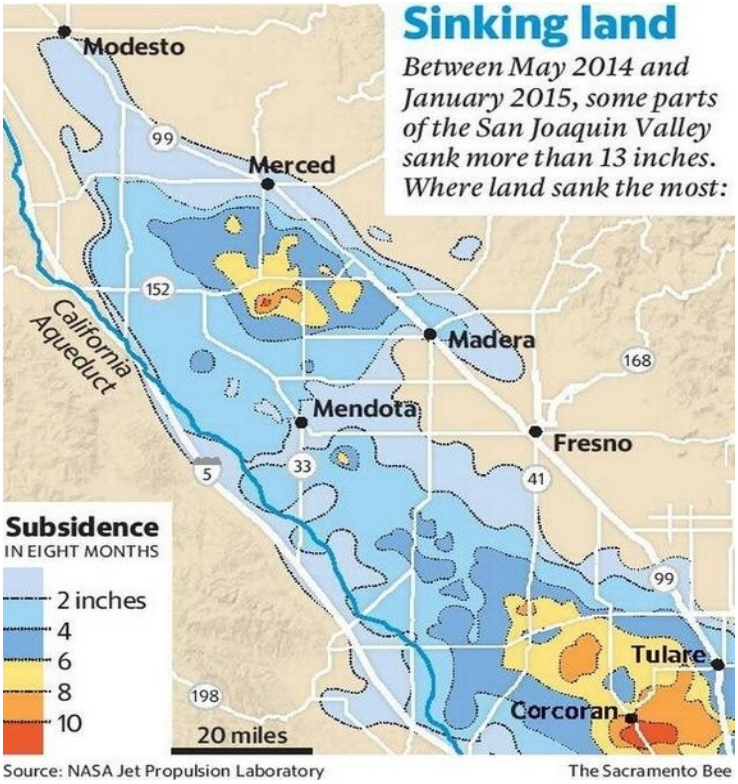
Yes. And impact of future droughts will be worse due to collapsing groundwater aquifers.

In addition to obvious and highly visible problems in snowpack and reservoirs, the five dry years of drought has seriously drained California's Aquifers.

The underground water supply has been tapped by increasingly deep wells to the point that the ground has begun to collapse in some areas — actually lowering the ground level in areas of the Central Valley.

In some cases, the aquifers are damaged by the collapse and won't be able to hold as much water when they refill.

The aquifers will take years and years to replenish and with less capacity due to collapse, it will make future droughts more of a danger.



While the following article is more than one year old, it does provide useful background:

9 sobering facts about California's groundwater problem

By Nathan Halverson

June 25, 2015

https://www.revealnews.org/article/9-sobering-facts-about-californias-groundwater-problem/

Jay Lund in his California Water Blog points out some other problems that shall persist even if the drought does end:

Tails of California's Drought

Posted on January 10, 2017 by jaylund

https://californiawaterblog.com/2017/01/10/tails-of-californias-drought/

Droughts often have long tails, especially for extended droughts over such a large state. Groundwater in the southern Central Valley might rise some, but will remain low, keeping some wells stranded and increasing pumping costs for years and perhaps decades. Drought damage to California's forests could require decades to recover, or, if higher temperatures persist, the ecology of many forests might shift to new normal conditions. Native fish also will likely need years to recover – with impediments from already depleted numbers and highly disrupted and altered ecosystems.

Feature

To Solve California's Water Problem, Study and Think

We continue this week our series elaborating on "LaRouche's Four Laws" to restore the U.S. productive economy.

Four weeks ago the "Feature" focused on step one, the reinstatement of the Glass-Steagall banking law.
http://www.californiadroughtupdate.org/pdf/20161215-California-Drought-Update.pdf

Two weeks we focused on step two: The Hamiltonian Banking and Credit system.
http://www.californiadroughtupdate.org/pdf/20161229-California-Drought-Update.pdf

Last week we presented Larouche's Third Law: "Federal Credit to Increase Physical Productivity," sometimes referred to as Infrastructure. To quote LaRouche:

"Concentrate on those areas of investment that most increase the energy flux density of the economy as a whole, including infrastructure, scientific and technological R&D. This means trillions of dollars in capital investment, to build a 21st century infrastructure grid along the lines of the World Land-Bridge."
http://www.californiadroughtupdate.org/pdf/20170105-California-Drought-Update.pdf

This week we shall continue the discussion of the Third Law, but, as the following excerpts from the following emphasizes, the term "infrastructure" is really inadequate. A better term to describe what is generally called infrastructure is "raising the productive power of the economy to a higher platform, increasing the power of the economy through a focus on frontier technologies which transform the

entire economy."

Here are excerpts from the January 6 LaRouche PAC webcast, which discusses this principle. I urge you to watch the entire discussion by going to the link. That is followed by an item on water infrastructure.

Countdown to a New Presidency: Mobilize for Glass-Steagall

LaRouche PAC Weekly Webcast
January 6, 2017
https://larouchepac.com/20170106/countdown-new-presidency-mobilize-glass-steagall

BENJAMIN DENISTON: The key point is that Mr. LaRouche has defined the scientific standard for a recovery of the United States; that's true, but more fundamentally, for the future of mankind. His work in defining a more rigorous science – he definitely drew upon the work of Hamilton and followers of Hamilton -- but he made a completely revolutionary discovery in terms of what is the actual hard, physical science underlying human progress, underlying economics. One area that we're doing some work on, this is kind of a critical convergence point in the fight around understanding these issues, is what people call infrastructure. It's become a kind of hot, popular word; everyone just says it. Republicans say it, Democrats say it; it's become kind of a buzz word as some people have said. It's as American as apple pie at this point; everyone talks about how great infrastructure is. I think Schwarzenegger even struggled to pronounce it once or twice in California. But do people know what it actually means? That's a fight that Mr. LaRouche has waged in the recent years, that people don't understand what the real significance of full-scale, integrated infrastructure systems is. You're not going to define what's needed in terms of the next level of infrastructure if you're not operating from the standpoint of an insight into the role actually plays inrevolutionary economic progress.

You can have a lot of discussions about how we need to rebuild this, this is decaying, our water systems -- the American Society of Civil Engineers I think it is, puts out this report card, and you can just run through it on the infrastructure systems and it's just horrendous. The water leakage, the transportation systems being run down, the power systems, the locks and dams that are ready to bust. But the issue is not just repairing all of those things; the issue is infrastructure mediates a process by which mankind is able to initiate completely unique and revolutionary self-transformations in mankind's very nature of his relationship to the natural world, so-called. Mr. LaRouche pioneered key metrics of this with his work on potential relative population density, for example; and actually examining how we can quantify and understand the fundamental nature of human economic progress.

One starting point might be if you just take the standpoint of ecology; ecology is a general idea of studying a species' relation to an environment. If you apply that to species, you're able to define certain characteristics of what that species is; not just by its color, or size, or mass, but by how it relates to the natural world -- to the biosphere around it. That as much defines that species as its other characteristics.

So, it's a general study for life that has validity. But what happens when you apply that to mankind? You don't get any fixed metric; mankind is not defined by any particular ecological relationship to the environment. What you see that distinguishes mankind is something fascinating; that mankind actually changes those metrics. Mankind's very nature is the fact that he can fundamentally change his relationship with the natural world through his own actions and the actions of society. You can measure this in terms of what Mr. LaRouche defined as the metric of potential relative population density. If you take any animal species, you can have some idea of a carrying capacity, a maximum

potential population that could be sustained for that species in an environment in the biosphere as a whole, for example. You can apply similar studies for mankind, and you can define -- maybe in broad strokes -- certain boundary conditions for the number of people the planet can sustain. But those change; and that's the most fascinating thing. Mankind changes those characteristics. Today, we have 7-8 billion people on the planet; hopefully increasing now that we have some order in the world moving in a better direction. You go back to society 1000 years ago, you could not have supported that level of population in the conditions of human society back at that time. Today, you can; and if we win, tomorrow we'll be able to support a whole lot more.

What drives that? This concept is critical right now, because especially in the West in the United States, people have really gone full on board with this zero-growth idea. The very fundamental concept of completely revolutionizing our society as a whole to support an order-of-magnitude higher population,completely revolutionary technological development -- that should be natural; that's not in most people's minds today.

But that's infrastructure! That's what infrastructure is. Infrastructure is an expression of defining how mankind creates a system by which he relates to the natural world. I think some of Mr. LaRouche's work on this is really worth digging into a lot more. He took his understanding of potential relative population density to some degree to a new level with this concept of the physical-economic platform, as a proper understanding of what "infrastructure" really is. He laid out this amazing insight into the arc of human development as expressed in a motion between successive physical-economic platforms. He said go back as far as we have records of civilized humanity, to what is sometimes called "pre-history," and certain insights into very ancient intercontinental ocean maritime civilization that was very sophisticated. It could travel the world much earlier than most modern academics admit.

Here is the second article (excerpts). It is a more limited discussion, but does provide some perspective on the role of water infrastructure in upgrading the workforce and the economy.

Why Donald Trump Should Focus on Improving Water Infrastructure

By Jim Lauria

January 5, 2017

In an open letter to the president-elect, Jim Lauria writes that improving water systems will help increase jobs, reverse decades of decline and ensure a commitment to safe drinking water for all Americans.

https://www.newsdeeply.com/water/community/2017/01/05/why-donald-trump-should-focus-on-improving-water-infrastructure

As I told political candidates back in 2010, water is the ultimate nonpartisan issue, uniting all Americans – rural and urban, rich and poor, liberal and conservative – in the basic biological quest for clean water. But our water infrastructure is severely challenged, and sinks deeper into disrepair every day. The American Society of Civil Engineers (ASCE) graded our drinking water and wastewater systems a "D" in its Infrastructure Report Card. The American Water Works Association (AWWA) estimates the needed repairs to our water delivery infrastructure, including pipes in many cities that are more than 100 years old, to cost $1 trillion.

That's a lot of investment. It's also a lot of jobs.