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Game Changers – Breaking The Winter Of 2014

IN THIS ISSUE

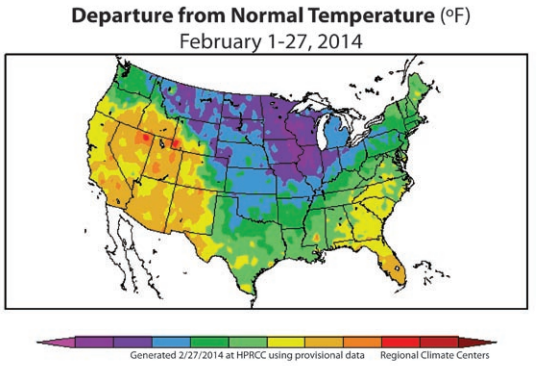
- With the frozen Great Lakes, springtime in the Midwest, Northeast and Eastern Canada will be cooler and wetter, delaying spring planting for a couple of weeks.
- There will be more rainfall in California and the West but not enough to break the drought.
- The eruption of Mt. Kelud is large enough to affect global climate. Historically large tropical volcano eruptions enhance the strength of El Niño weather. This would have a favorable impact on the US and Canadian growing season but cause problems elsewhere.
- With the cool phase of the Pacific Decadal Oscillation, California, the world's fifth largest supplier of food and agricultural commodities, and the western US face another 15 – 20 years of a drier new normal.
- This cool phase of the PDO will continue to limit the supply of water and, in the current California political setting, politics will continue to limit the access of water for agriculture.

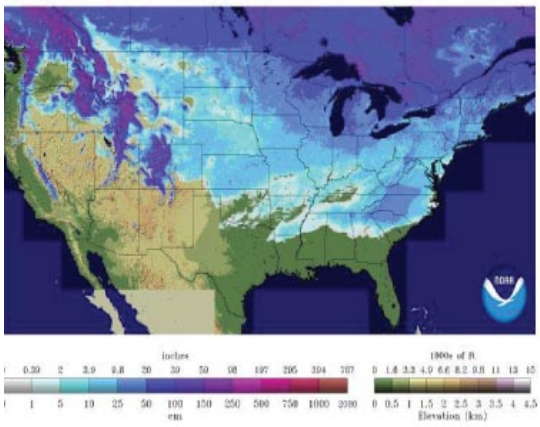
CONTENTS

SUMMARY

The upcoming spring and summer will be shaped by cold Arctic air mass, the warming Atlantic and Tropical Pacific and the giant eruption of Indonesia's Mt. Kelud. Typically this produces a volatile spring with late planting and a moderate El Niño summer that is good for crops.

The winter of 2014 has been a record breaker, breaking tens of thousands of cold, snow and drought records. In the Eastern and Central States cold front after cold front stormed through the countryside. In the West, California shriveled in its greatest drought in a century. When the East complains about too much snow, the parched West regards it as bragging.





figs. 1A-B **February has dramatically cold temperatures in the Midwest and saw snow in 49 states on February 13.**
top: http://www.hprcc.unl.edu/products/maps/acis/MonthTDeptUS.png
bottom courtesy NOAA

When Will the Madness End?

Ironically, NOAA classified the overall temperature for the Lower 48 in January and early February as near average. This is because the above-average warmth in the West balanced out the below-average temperatures east of the Rockies. Eighteen states from Michigan and Wisconsin to the Southeast recorded a top 15 coldest January. February continued the misery and will end with a final freezing flurry.

The reason for this has been the extremely volatile jet stream. Both the North Atlantic and North Pacific are warmer than average and the polar air mass is much colder than average. Normally the cold Arctic air would smoothly flow south during wintertime. This year, however, the warmth of the Pacific has forced the eastward flowing polar jet stream to remain far to the north. Through most of the winter of 2014, it has entered North America through the panhandle of Alaska. When it crossed the Rockies, it plunged south, much farther south than normal. Then, when it hit the

This newsletter contains articles, observations and facts to support our contention that humanity is significantly influenced by changing climate.

Our calculations show the climate, over the next term, will cause dramatic changes in our social and economic patterns. We feel that readers, attuned to the changes that are occurring, may develop a competitive edge; and, by understanding their current and future environment, can use the momentum of change to their advantage.
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warm, moist air from the warmer than average Atlantic, it produced ice storms and blizzards.

As the *Browning Newsletter* noted last September, 2013 had the coldest summer on record in the Arctic, so cold that there was 60% more sea ice than the previous year. Since 2011, volcanic debris from the eruptions of two polar volcanoes – Russia's Mt. Sheveluch and Iceland's Grímsvötn – has filtered and reduced incoming sunlight. This has created an unusually frigid Arctic and now it is not surprising that when the air plunged south it created some record cold temperatures. For the 48 contiguous states, January was the third coldest January on record and broke more than 4,800 snowfall records.

Below-average temperatures have also dominated much of February as well from parts of the Midwest and Plains to the Northeast. While not as record-breaking, cities including Chicago, St. Louis, Indianapolis, Green Bay, Wis., Dubuque, Iowa and Moline, Ill., have seen a top 10 coldest February. As the month draws to a close, the Arctic air mass (heralded by the press as the dreaded Polar Vortex} will once again make its descent deep into North America.

The cold has only been part of the problem. The other problem for the eastern two thirds of the continent is that the Atlantic is warmer than average. Warm wet air has crept inland from the Gulf of Mexico and the Atlantic. As the cold air mass collides with the moisture, it creates blizzards, ice storms and even the relatively uncommon thunder snows.

Now, as spring approaches, the Atlantic warming will increase and we will begin to see a major shift in the overall continental weather pattern. The season will become even more volatile as Gulf and Atlantic air creeps into the continent. This will create a battle of the air masses with the US particularly the Midwest, as the battleground.

In many ways, this will create a break. For short periods, especially toward the middle of March, the jet stream will level out, allowing more warmth to flow into the Southeast and even the Mid-Atlantic states. To the west, this means the jet stream and winter rains will enter the West Coast further south, allowing rainfall to hit the Pacific Northeast and, occasionally, Northern California. This does not mean a "Miracle March" will break the drought – just that the West will get some much-needed precipitation. [EDITOR'S NOTE – There will be more discussion of the Western drought in the second article.]

Precipitation may not be as appreciated in the Midwest. The region has been so cold that an incredible 88% of the Great Lakes- Superior, Michigan, Huron, Ontario and Erie—are now frozen over. That's the largest ice cover the Great Lakes have experienced since 1994, and it means that there is an astounding 82,940 sq. miles (214,814 sq. km) of ice. (To give a sense of perspective, back in 2002, just 9.5% of the Great Lakes froze over. Normally, only 50% of the water surface freezes.) Historically this creates a cooler, wetter springtime, with frequent floods and delayed planting through Eastern Canada and the Midwest.

fig. 4 **The frozen Great Lakes will delay Midwestern and Canadian spring warming.**

image taken February 19, 2014, courtesy: NASA

While the climate factors that are shaping this winter and spring are already surrounding North America, the factors that will shape this summer come from the distant Tropical Pacific.

Gamechanger – The Eruption Of Kelud

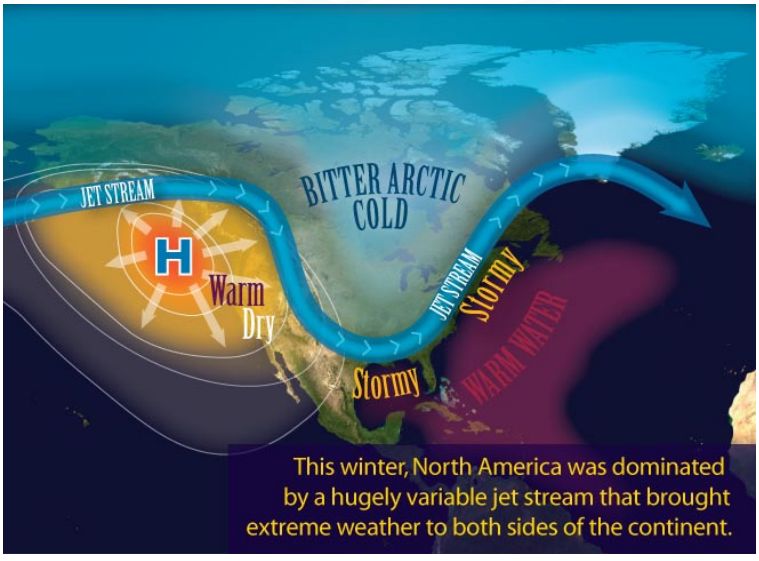


fig. 2

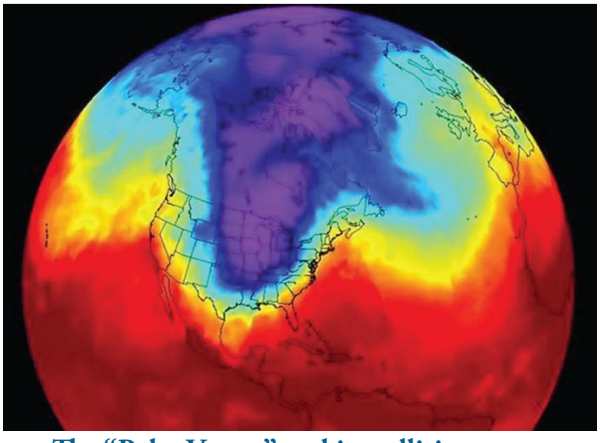


fig. 3 **The "Polar Vortex" and its collision with the warm Atlantic** *coutesy:NASA*

fig. 5 **Indonesia's major volcanoes** *http://en.wikipedia.org/wiki/File:Map_indonesia_volcanoes.gif*

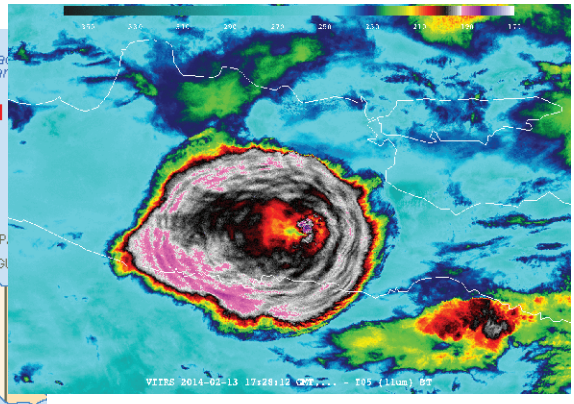


fig. 6 **A satellite photo of the eruption of Kelut (circle) showed the heat and that it penetrated into the stratosphere.** *http://cimss.ssec.wisc.edu/goes/blog/wp-content/uploads/2014/02/140213_MTSAT1R_IR_KELUD_EAST_JAVA_10.GIF*

Indonesia is no stranger to volcano eruptions. It currently has more than 150 volcanoes, 31 of them active with 8 erupting.

On February 1, as the last Newsletter was distributed, an Indonesian volcano erupted – Mt. Sinabung on the northern island of Sumatra. It had been spewing ash for months, but the sudden explosion at the beginning of the month killed 16 people, including a group of schoolchildren on a field trip to help distribute aid to the more than 30,000 people displaced by the volcano's activity. As tragic as the eruption was, it was a relatively small eruption, only 4 to 5 km high (2.5 – 3.1 miles high). It, like most Indonesian eruptions over the past century, was too small to affect climate.

On February 13, Mt. Kelud on the central Indonesian island of Java, exploded. Fortunately, the mountain had been rumbling with seismic activity and the government warned 200,000 people to evacuate. More than 100,000 people fled to shelters and only four people died. Java closed its airports, as the mountain roared.

Then, as it historically does, Kelud quieted after a couple of days. Within three days, airplanes were flying and more than half the evacuees returned to take care of their abandoned livestock. There was even cheerful talk about the new jobs generated by the cleanup and the fertility that the volcanic ash had added to the local soil.

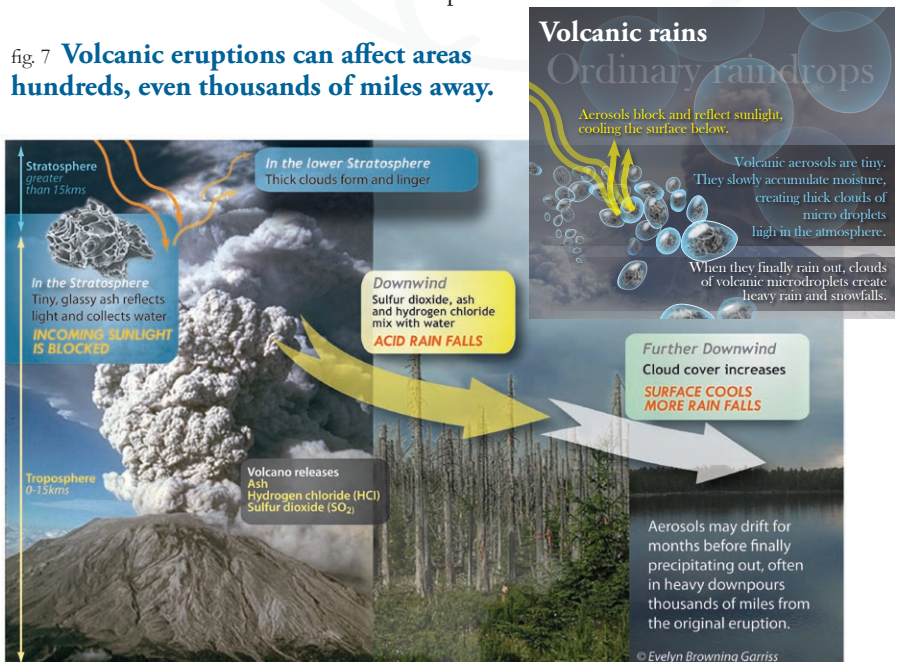
The eruption was over, but the impact of Kelud's eruption has only started. As the Browning Newsletter has repeatedly reported, a large volcano has a cascading effect on the climate. Most of the larger ash particles fall out within a few miles of the eruption. However, if the explosion is large enough to enter the quiet stratosphere, the volcanic aerosols (minute particles of ash and chemical debris) can linger for years. Water collects around these aerosols, forming micro-droplets too small to fall. These micro-droplets collect into thick clouds that continue to block incoming sunlight. This cools the surface of the Earth below. Eventually, the micro-droplets collect enough water and mass to precipitate out in the form of rain or snow. Since the clouds tend to be unusually dense – the precipitation frequently takes the form of blizzards or flooding rain.

However, the impact of large volcano eruptions varies, depending on the location of the explosion. Global winds tend to flow outward from the tropics toward the poles. As we saw following the 2011 eruptions of Mt. Grimsvötn and Sheveluch, the Arctic or Antarctic air masses tend to trap debris from polar volcanoes. It affects the middle latitudes during the cold events of late fall, winter and early spring, but retreats before summer warmth. The weather impact is concentrated, usually confined to one hemisphere.

Kelud will be different for several reasons.

1. This eruption is much bigger. While both Sheveluch and Grímsvötn entered the stratosphere, the stratosphere is only 4.5 to 6 km (2.8 – 3.7 miles) high over the poles. The stratosphere is roughly 18 km (11.2 miles) above the surface at the latitudes of Indonesia. This eruption is much larger than the two 2011 volcanoes.

fig. 7 **Volcanic eruptions can affect areas hundreds, even thousands of miles away.**



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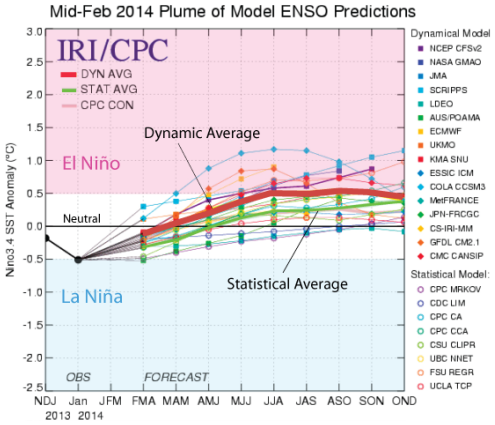


fig. 8 **Most dynamic models project El Niño conditions during the summer.**

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

2. The debris from large tropical volcanoes tends to spread globally. First, the debris spreads laterally around the equator, and then the winds carry the clouds of ash and chemicals toward the poles. When Pinatubo, the 1991 eruption in the Philippines, exploded, the debris took months to reach the middle latitude and didn't reach the poles until half a year later. Kelud's eruption will affect the tropics this summer and probably not reach the poles until late fall or winter.

3. Both Grimsvötn and Sheveluch had eruptions with high amounts of sulfur. Scientists know that sulfur, when mixed with water, forms shiny clouds that reflect enormous amounts of sunlight and promote cooling. Some volcanologists even believe that volcanic eruptions with low amounts of sulfur have no impact on climate. Kelud's debris has a relatively small percentage of sulfur. There will be scientists that predict it will not affect global climate. The *Browning Newsletter* believes it will affect climate but the impact will certainly be less than 1991's Pinatubo eruption.

If Kelud affects global climate – what will the impact be? Since pioneering work in 1984 by Paul Handler of the University of Illinois, Urbana, there has been increasing indications that large tropical volcano eruptions enhance El Niño weather. Note – neither event triggers the other. You can have a large tropical volcano eruption without an El Niño occurring and vice versa. But when the two coincide, the weather impact of the El Niño is usually stronger.

The majority of oceanology and climate services are projecting a warmer Tropical Pacific this summer with the majority of dynamic models (which have recently been more correct over the short run) projecting a weak El Niño. If this happens, then it is very likely that the impact of Kelud's eruption will make the event feel stronger. The waters will not be hotter but the effects on the weather will be more severe. This is good news for the US and Canadian agriculture but bad news for Indonesia, Malaysia, Australia (droughts) and portions of South America (flooding, landslides and reduced marine life populations).

Recent research is exploring the interaction of large tropical volcano eruptions on those other tropical weather phenomenon – monsoons. The results show that even smaller tropical eruptions can affect climate if timely monsoons loft the ash and chemical debris high into the atmosphere, as they did in 2012 with the eruption of Mt. Nabro in Eritrea. The debris can then cool certain regions. [EDITOR'S NOTE – There will be more information on this phenomenon in the News Notes.]

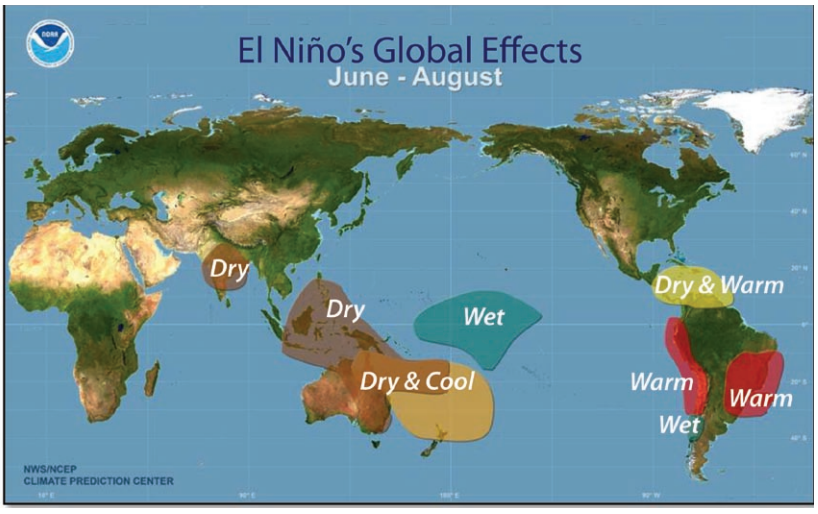


fig. 9 *http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/impacts/warm.gif*

Negative Dipole Mode

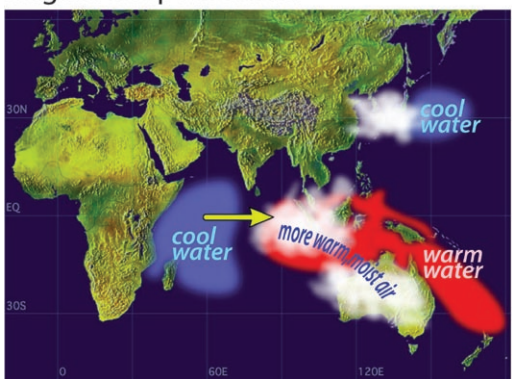


fig. 10 **The Negative Indian Ocean Dipole** *http://www.jamstec.go.jp/frsgc/research/d1/iod/e/iod/about_iod.html*

Since the strength of monsoons is shaped by the contrast of temperatures of land and water, cooling regions interferes with monsoons. In 2012, tree-ring researchers at Columbia University's Lamont-Doherty Earth Observatory (**LDEO**) showed that big eruptions tend to dry up much of Central Asia, but bring more rain to Southeast Asian countries including Vietnam, Laos, Cambodia, Thailand and Myanmar. The report was published in the online version of the American Geophysical Union (**AGU**) journal *Geophysical Research Letters.* Tree rings showed that huge swaths of southern China, Mongolia and surrounding areas consistently dried up in the year or two following big events, while mainland Southeast Asia received increased rain.

It is probable that there will be an El Niño this summer and, thanks to Mt. Kelud, it will have a moderate impact on global weather. This is very good news for the US but Australia and Indonesia need to prepare for dry conditions. India, which frequently sees its summer monsoons reduced by El Niños, especially if the Indian Ocean is in a negative phase of the Indian Ocean Dipole as it was in 2009, needs to be on the alert.

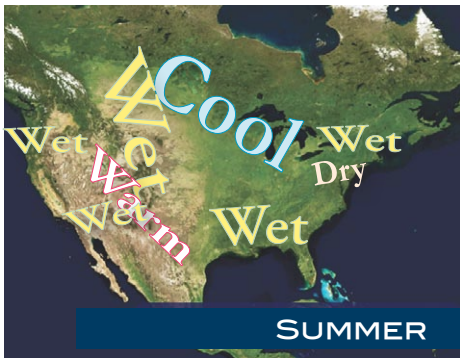
From Winter to Spring

In the past, the current type of conditions created an extremely volatile springtime. Above average warm surges from the Gulf battled frigid plunges of Arctic air while the West continued to suffer through varying degrees of dry weather. While normally the *Browning Newsletter* shows what happened in 80% of similar years, these types of years are typically too volatile for that methodology to work.

Instead, the following maps show what happened in 60% of similar years. In 60% of these years, there was one more warm front sweeping through the nation in March, creating an average of warmer weather in early spring. A cooler, wetter mid-spring followed that brought some flooding and delayed planting.

The big question is if and when El Niño conditions will arrive. There are some indications that it might start in late spring while others seem to indicate that it probably will be as late as mid-summer. In 60% of similar years, it arrived sometime in early summer and was a normal El Niño rather than an El Niño Modoki that intensified the drought in California. The following map shows the overall weather and growing conditions for the US and Canada in these types of years. By next month, the developments in the Pacific for late spring and the growing season will be much more certain.

Overall, between the extraordinarily cold Arctic air mass, the warming Atlantic and Tropical Pacific and the impact of Mt. Kelud, it looks as if it will be a volatile spring with late planting that will develop into an excellent growing season for most of North America. In years like this, farming is never easy, but the harvests tend to be very good.



Cold	Cool	Warm	Dry	Wet
5°C or more lower than normal temps.	2-4°C or more lower than normal temps.	2-4°C or more higher than normal temps.	75% or less of normal moisture	125% or more of normal moisture

figs. 11A-C * Pacific volcanos may bring more moisture to the Northwest

US Waters – Realities and Legalities

SUMMARY

The current drought in California and the West is the beginning of a 20 – 30 year drier phase of the Pacific Decadal Oscillation. The cool phase of the PDO will continue to limit the supply of water and Federal law and California politics will continue to limit the access of water for agriculture.

The Western US and portions of the Prairie Provinces are dry. In California, the shortages have created an official state of emergency for the nation's most populous state. When a lack of water limits the twelfth largest economy in the world, it is worth studying and determining if this drought is temporary or long-term and what its impact will be. California is the world's fifth largest supplier of food and agriculture commodities, and if drought limits its agriculture, the impact will be felt far beyond its borders.

Notice – an area can be routinely dry but not in drought. Parts of Washington State, classified as drought stricken by the US Drought Monitor, are receiving more rainfall than parts of West Texas that are classified as normal. **Drought is when the demand outstrips the supply. Here in the US, the available supply is determined by the actual amount of water through precipitation and snowmelt and the laws/regulations that make the water available to satisfy the demand.**

The Reality of Western Water Supplies

The reality is that the United States is one nation with a multitude of climate zones and most of the regions west of the 100°W meridian are dry. Similarly, California is split with most of its middle

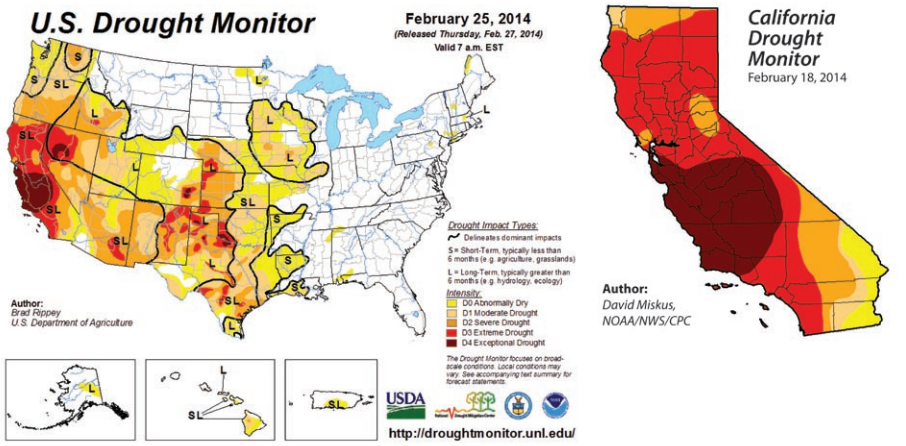
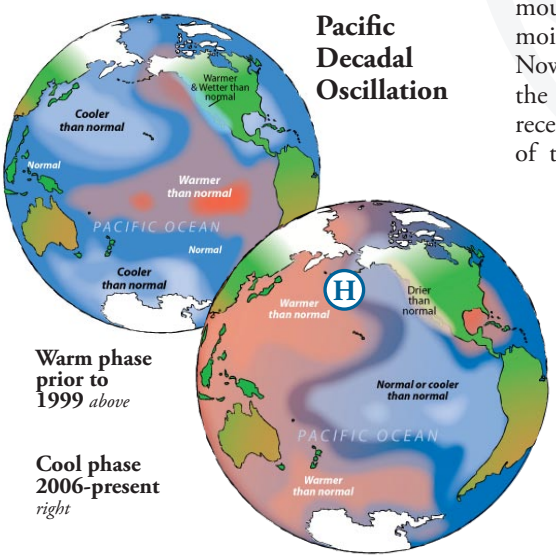


fig. 12A-B **Currently 53% of the Contiguous US is dry or in drought but 100% of California is dry or in drought.**
http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?CA

and southern regions being desert. In the best of times, none of these areas has abundant water.

THE PACIFIC DECADAL OSCILLATION – This is not the best of times. Western moisture flows inland from the Pacific and the Pacific goes through numerous natural cycles. One of the longer cycles is the Pacific Decadal Oscillation **(PDO)**, which switches warmer and cooler water east and west across the ocean. From 1976 – 1998, the PDO was in its positive phase and the water off the coast of North America tended to be warmer. The warm water heated the air above it and the warm air held abundant moisture. The prevailing westerly winds blew the moisture inland



figs 13A-B © Evelyn Browning Garriss

and most of the West had relatively reliable supplies of water. In many regions, like California with its Mediterranean climate, the moisture was mostly in the winter and in the form of mountain snowpack. As a result, much of the American west depends on reservoirs storing and dispensing melted snow.

Starting in 1999, the PDO began to change phases from positive to negative. Different scientists disagree on when the PDO became negative, but some have claimed that it finally tipped in 2006. Not only is the trend for the waters off the West Coast to have cooler average temperatures, but increasingly there is a blocking high in the North Pacific that stops or delays winter rainfall. Last year, the Pacific High that normally appears in summer and shifts in the winter rainy season, remained in place for roughly thirteen months.

At the same time, the Atlantic is in its warm phase, the positive phase of the 60 – 70 year Atlantic Multidecadal Oscillation. Research has shown that when the Atlantic is cool and the Pacific warm, as they were through parts of the 1970s, 1980s and 1990s, they create the most benign conditions for North American agriculture. With both oceans shifting, the US, particularly the West are in a new "normal".

Notice, California is always prone to drought. (in fig. 14A-C The dark orange areas in the maps typically experience dry weather 20% of the time.) However, in a positive PDO, with a warm Pacific, the mountains typically received adequate moisture to provide a good snowpack. Now, when coastal California is dry, so are the mountains. This means the reservoirs receive less water and currently all but three of the state's major reservoirs are below 50%.

GROWING POPULATIONS AND DEMAND – This is not the first time that the PDO is in a negative phase. The US had similar rainfall problems in the 1950s through the early 1970s. However, between those days and now the population of California has doubled (to 32 million). This created a growing economy with growing subdivisions and lush, water-consuming lawns.

During the previous negative phase of the PDO, the West built a flurry of reservoirs. California designed the California State Water Project, operated by the state Department of Water Resources. This series of reservoirs, aqueducts, power plants and pumping plants stores and delivers water to two-thirds of California's population. During the prolonged coastal drought of the 1990s, a new Coastal Aqueduct was constructed to deliver water to the Central Coast. Other than that, almost no major water projects were designed or developed during the past 30 years.

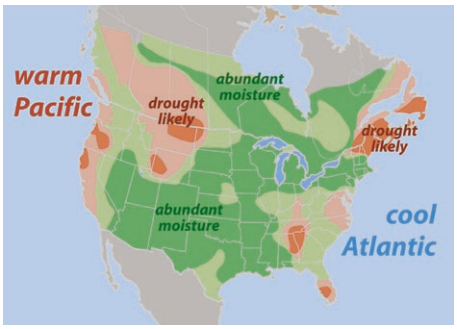
The reality of California is that as the population and demand for water exploded – the resources to store or supply that water remained almost unchanged. To a lesser extent, the same is true for most of the American West.

The Legalities Controlling Water In the American West

One of the ironies of managing water resources in the American West is that most of the nation's legal approaches to water management are derived from English law. England is a land with a history of abundant water (a bit too abundant this winter). When the 13 colonies were established, they were founded in the relatively wet climates along the Atlantic shore. Their legal systems were derived from Mother England and its rules fit their environment.

Unfortunately, these rules do not fit the much drier environments of most of the lands west of the 100˚W meridian (mid –Dakotas to mid- Texas). Most of these lands, between 1981 and 2010 averaged

fig. 14A *below,* **From the mid 1970s to the late 1990s the US and Canada enjoyed the most benign combination of the PDO and the AMO.**



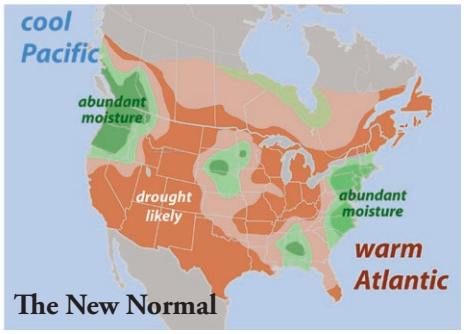


fig. 14B-C *right, top and bottom*
Since 2006, the two oceans have combined to create dry weather in the West and Great Plains.

© Evelyn Browning Garriss, US datateUSGS

less than 25 inches (63.5 cm) of rainfall a year. At the same time, the western states had a different settlement history, with many of these regions, including California, starting as Spanish colonies. They inherited water traditions from Spain. Spain, once ruled by the Moors, Arab/African Moslems, had a legal system that treated water as a limited resource. Thus, the US finds itself divided not only by climate but also by water law.

RIPARIAN RIGHTS – All Eastern states water laws are based on English Riparian Doctrine. Under riparian law, water is a wandering thing like the air, sunlight, or wildlife. It is not "owned" by the government or private individuals, but is rather part of the land. All landowners whose property adjoins a body of water have the right to make "reasonable use" of it as it flows through or over their property. If there is not enough water to satisfy all users, the people with the greatest frontage on the water have the largest allotments. All landowners lose water during dry times. Landholders cannot sell or transfer their water rights out of a watershed if this interferes with downstream water usage.

PRIOR APPROPRIATION – Most Western states follow the doctrine of prior appropriation. This doctrine is basically "first in time, first in right." It is based on Spanish traditions and was recognized first in Colorado in 1872 in *Yunker v. Nichols, 1 Colo. 552 (1872).* That case ruled that the first owner of a water source has a superior right to newer owners. If there is a shortage, the first owner gets their full allotment, then the next and so on with the newest owner having to absorb the loss. This system fundamentally kept populations from overloading a water source and producing a general shortage. Within 20 years of the court case, the so-called Colorado Doctrine had been adopted, in whole or part, by most of the states in the Western United States that had a dry climate. Most of these states also have a "use it or lose it" clause to keep absentee landlords from controlling water.

Each of these systems has their strengths. The riparian system allows rapid change. Any entity that wants access to water merely has to own land. Nevertheless, in times of shortages, all suffer. In the prior appropriation system, rights to water are much more protected, but it is more difficult to initiate change. Many municipalities complain because so many water rights are dominated by rural areas with strong agricultural needs and low populations.

It should be noted – whenever there is a dispute over water rights that go to federal courts – federal water law is dominated by riparian rights. This means all stakeholders have water rights, even if this deprives previous owners of water. In recent decisions, environmentalists have chosen to appeal to federal courts, which will allot water for wildlife, even if this restricts water availability for cities and farms.

Because the California State Water Project delivers so much of the waters of California, bureaucrats manage water allotments. Similarly, Federal waters in California are bureaucratically allotted. This has made water rights even more changeable and, in times of drought, tentative. Last year California received just 20% of their normal allotments from the federal Central Valley Project, while federal water releases for endangered fish remained at 100%. When summer came, both the Federal Bureau of Reclamation and state Department of Water Resources systematically drained northern California reservoirs to fill water banks and Southern California reservoirs. Now most northern reservoirs are quite low (Folsom is at 17%) while southern reservoirs are at 105% of average. This January, the California Department of Water Resources announced that if dry conditions continue, urban and rural water agencies will not receive any water from the State Water Project.

Conclusions

- California and the US West are not in the dreaded "mega-drought" that newspapers are heralding but, with the cool phase of the Pacific Decadal Oscillation, they face another 15 – 20 years of a drier new normal. Even when the current drought ends, overall climate will remain drier, with less reliable winter snowpack.
- These drier conditions are being managed using a variety of water policies. However, the over-riding Federal management system is based on riparian rights, which do not fit the needs of arid climates and limited water resources.
- California water is bureaucratically managed; meaning water rights are tentative and can be politically altered. In the current California political setting, urban and environmental interests are far more influential than agriculture. This cool phase of the PDO will continue to limit the supply of water and California politics will continue to limit the access of water for agriculture.
- When a severe drought hits the twelfth largest economy and the world's fifth largest supplier of food and agriculture commodities, the economic impact will be felt beyond state and even national borders.

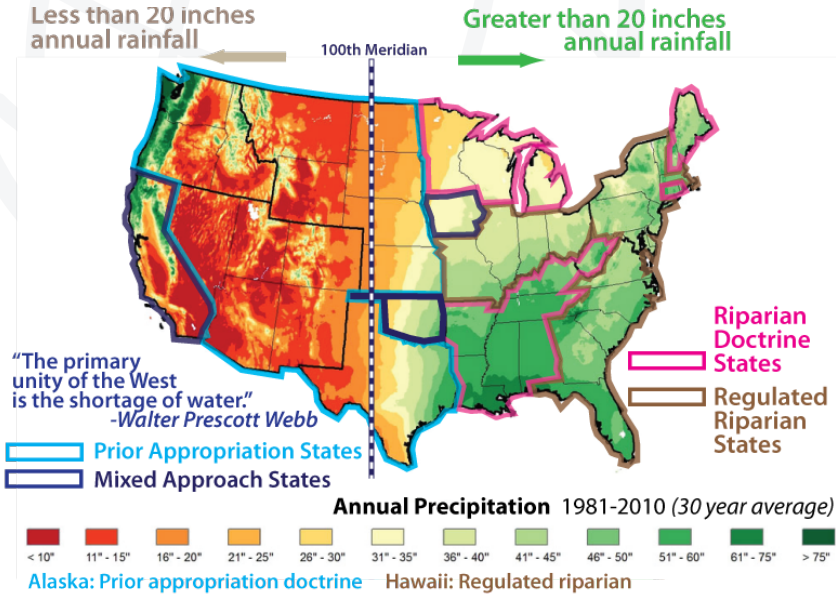


fig. 15

http://globalchange.gov/whats-new/agency-news/947-new-reports-explore-how-a-shifting-climate-may-impact-eight-us-regions-

News Notes

The latest science is reporting that volcanoes are partly to blame for global warming 'pause'. A report in the February 23, 2014 issue of *Nature Geoscience* by Benjamin D. Santer, et al. reports that **small volcanoes are shaping climate and contributing to the recent pause in global warming**. Climate modelers have been puzzled because the Earth was warming rapidly until 1998 when the warming halted. Now the scientists are saying that 17 small eruptions, between 2000 and now cooled the climate and are responsible for 15% of the pause.

In 2011, scientists discovered that small volcanoes could significantly change the planet's climate. Before then, researchers thought that only big eruptions the size of 1991's Mount Pinatubo blast could effectively cool the Earth. Most climate models reflected this bias toward big eruptions, ignoring climate shifts from smaller blasts.

It turns out that a series of 17 small/medium volcanic eruptions since 2000 pumped enough ash and chemicals into the atmosphere to partially offset any warming caused by greenhouse gases such as carbon dioxide, the researchers claim. Smaller volcanoes in northern latitudes can enter the stratosphere where their impact lingers. At the same time, medium volcanoes in monsoon zones can have the seasonal winds carry their debris far higher than the actual explosion, entering the stratosphere. The new study correlated shifts in reflected sunlight and global temperatures directly with the 17 explosions. This series of medium-sized eruptions show little signs of slowing. Think – small but mighty

Brazil and Argentina are facing some severe weather problems. Previously it was drought, now it is continued dry weather in Argentina and eastern Brazil and too much rainfall in Bazil's western crop regions. The rain is a triple threat to Brazil; it is endangering the "soybean express" the roads and bridges that transport the harvests. It is forcing farmers to either delay harvest or harvest wet and it is delaying the corn-planting season. Experts are cutting their expectations of amount and quality. Meanwhile dry weather is cutting Brazilian sugar and coffee production and Argentine grains, raising commodity prices.

To the extent Brazilian weather is shaped by tropical oscillations, the outlook is that weather problems will continue through the middle of March.

Remember – the same conditions creating extreme weather in North America are distorting normal weather in other portions of the world. The hotter temperatures of the Atlantic correlate with reduced precipitation in Iran. Satellite photos show that the nation's largest lake, Lake Oroumieh, has shrunk by 80% in the last decade. Experts estimate the lake may be dry in two years.

Shivering Americans want to know – when do people welcome cold windy weather? The answer – when they are Northern Chinese wading through the smog. While cold air pummeled North America, Europe and Northern China endured relative warmth. In Northern China, particularly around Beijing, it also meant smog. Beijing has been choking with smog for almost 13 months straight. In February, smog continually covered between 15 – 25% of the nation. As the month draws to a close, forecasters are predicting a sharp windy cold front that may blow the smog away. Bring it on!

Some experts have used the snow problems with Sochi as an example of global warming. Unfortunately, for this argument, Sochi is in a subtropical corner of Russia where it never snows on the coast and where the mountain snow base can vary dramatically from year to year. Temperature lows rarely dip below freezing for long periods during the winter, averaging out at about 52˚F (11˚C). For Pete's sake – palm trees line Sochi's streets!

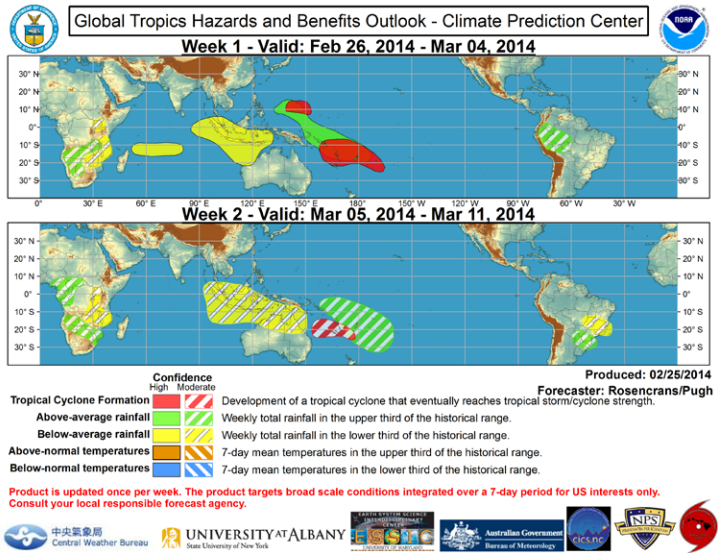


fig. 16 *http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php*

The opinions expressed are those of the writer, and although they are based on extensive studies of physical data and phenomena, many statements published here are not entitled to be regarded as rigorously proved in a scientific sense. Some decades must pass before these issues are resolved. Meanwhile, decisions must be based on the best available information and estimates.

This newsletter will **not** contain:

- *Analysis of, or recommendations concerning, any investment possibilities.*
- *Recommendations on any particular course of action.*