

# REPORT FROM THE FIELD

JUN '19

By

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With

Marsha Neill & Bob Waidner

Now that the Poppy Reserve's visitor Center is closed until next year and the spring's wildflower season is drawing to a close, it's probably a good time to summarize what happened this spring. Unfortunately, the lingering aftereffects of a medical treatment I had to undertake prevented me from visiting the Reserve after mid-March so I missed almost the entire poppy season this year. All of the readers who were fortunate enough to have visited the Reserve this spring know what I missed. Thanks to NASA this statement is not completely correct; more on this a little later.

With the Poppy Reserve's "official" weather station accessible through the internet, I was still able to keep track of the Reserve's weather even from home and can therefore make some comments on how this past winter's weather likely impacted the Reserve's resulting spring wildflower displays.

There was so much media hype about this winter's record rainfalls here, there and everywhere and these record rainfalls account for this spring's outstanding wildflower displays. Neither claim tells the whole truth. The record rainfalls that did occur this past winter were mostly due to the numerous "atmospheric rivers" that happened to be aimed at the California coast this year.

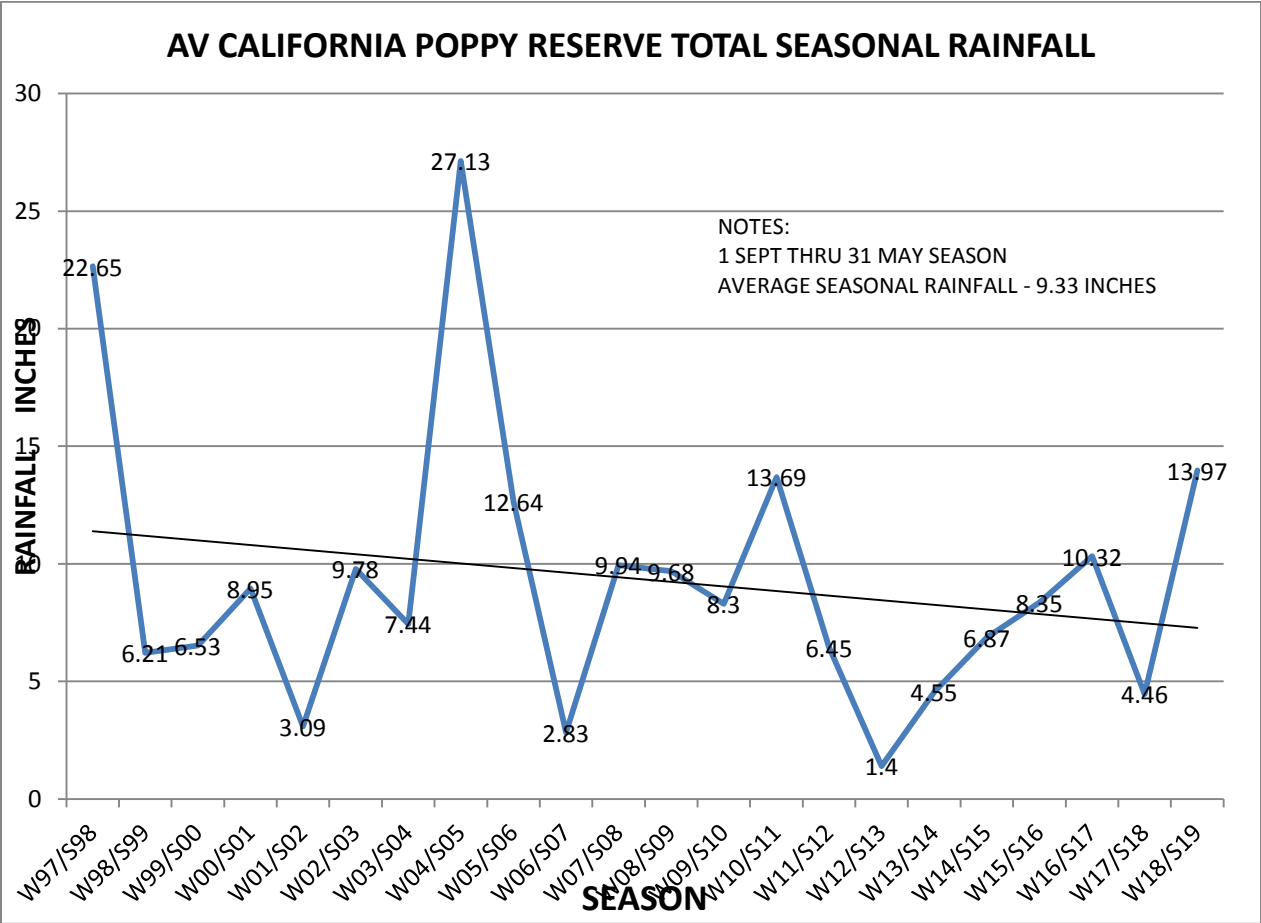
"Atmospheric rivers" are relatively narrow (on average, approximately 300 miles wide) highly moist masses of air that originate in the warm Pacific waters near Hawaii and are blown northeast towards the west coast of North America by the prevailing jet stream winds. Because these periodically forming atmospheric rivers contain so much moisture, they typically provide 30% to 50% of the west coast's total rain and snow fall. The actual jet stream pattern that exists when an atmospheric river forms determines what part of North America's west coast is impacted from, probably, British Columbia to Southern California and, maybe, even Mexico. Varying moisture content and speed of movement determines the actual impact of each atmospheric river but the strongest atmospheric rivers are the cause of historic flooding, snowfall, etc. For example, one October I was standing on a bridge over a river in the Northern California redwoods and the river was 10 to 15 feet below the bridge. I then could look up at a redwood tree growing next to the bridge and see the high water mud mark 15 to 20 feet above the bridge still remaining from a historic flood that had occurred years earlier. I still remember that experience to this day. Because atmospheric rivers are so narrow, this type of extreme damage impacts only the small length of the entire coast that is directly facing the atmospheric river.

Even if Northern California had historic snowfalls and Los Angeles had historic seasonal rainfall, the Poppy Reserve itself did not come close to having a record seasonal rainfall. In fact, this winter/spring accumulative rainfall total is only approximately half of the record rainfall over the last twenty two years. Figure 1 shows the Poppy Reserve's total seasonal rainfall for each year beginning in the winter/spring of 1997/1998.

It should first be noted that the seasonal rainfall for this season, W18/S19, is only through 21 May '19; the time of preparing this article. With rain forecast for several days during the last week in May, the final total seasonal rainfall will likely be slightly higher. Although this season will be the third wettest in the last twenty two years, it will still be only slightly more than 50% of the peak rainfall year, W04/S05. That year, the Poppy Reserve was likely to have been more directly impacted by several strong atmospheric rivers. During that season, there were two multi-day rainstorms that deposited almost six inches of total rainfall each and a third multi-day rainstorm with slightly less total rainfall but one day alone had over three inches of rainfall.

This year's May rainstorms are actually not that uncommon. Ten of the last twenty two years have received May rainfall. Although both May 1998 and May 2005 had more total monthly rainfall than this year (0.7 inches), most years have had only a few tenths of an inch or less of total monthly rainfall in May.

Even with this season's higher rainfall, the best fit linear trend line still shows a decreasing seasonal rainfall over the last twenty two years. If this trend continues, it likely will eventually lead to less frequent outstanding poppy display years.



**FIGURE 1: AV CALIF POPPY RESERVE SEASONAL RAINFALL**

Having clearly refuted that the Poppy Reserve had record rainfall this winter/spring, lets address that this year's large rainfall resulted in the outstanding poppy displays. This can easily be done by noting that W02/S03 had, at least as good if not even better, spectacular poppy displays that year even though it had only 70% of this year's total seasonal rainfall. There is even some data that supports that only seven to eight inches of total rainfall is required to have outstanding poppy displays. This uncertainty in even the amount of rainfall required for outstanding poppy displays points out the importance of establishing a methodology that quantitatively ranks the quality of each year's poppy displays which, in turn, could lead to a better understanding of the combination of factors that results in outstanding poppy displays.

One of the primary objectives for the volunteer researchers' mid-March Reserve visit was to take the first panoramic photographs from a series of set locations established on the Reserve with the intent of repeating these photographs throughout the poppy season. Having a consistent set of photographs documenting the progression of poppy color throughout the season would, hopefully, eventually lead to the development of a grading system allowing the quality of one season to be compared to previous seasons. This data might also better define the timing of the peak poppy color and how the peak color location moves through the season.

Figure 2 shows three of several dozen photographs taken on 13 March '19. Except for one or two other photographs, only these three photographs showed the faintest flush of generalized poppy color. All the photographs show south facing slopes. Photograph "A" shows the western side of the Reserve. Because the color is so faint, I marked two areas that I think are showing a little color. Actually, the color looks more like goldfields than poppies in this photograph.







**Figure 2 A,B&C: SET PHOTOGRAPHS ON 13 MARCH 2019**

The photograph in Figure 2B shows the slopes below Kitanemuk Vista Point and the photograph in Figure 2C is a view further east below the Lightning Bolt trail. I believe both photographs are showing the first flush of poppy color. The eastern part of the Reserve appears to be markedly greener than further west but that could be the camera's automatic exposure adjustment.

Figure 3 shows the progression of the poppy displays from mid-March to very early April. The photographs shown in this figure were taken by NASA photographer Jim Ross as he flew over the Reserve on 2 April '19. At first, the color intensity in these photographs made me speechless and that is hard to do. Their awesome beauty simply took my breath away. These photos certainly don't need arrows to point out color. And then I started to look a little closer at where the poppy displays were the greatest. In some years, the best poppy displays have been outside the Reserve in the surrounding areas. For this spring season, the best poppy displays were limited largely to the Poppy Reserve and even here actually only the south facing slopes. North of the buttes' summits the generalized poppy color is quite patchy and in the central and more western section of the Reserve were also limited. For example, there are limited poppies south of the maintenance yard and the poppy color stops just south of the southern loop of the Poppy Loop Trail. Except for the southern facing slope below Tehachapi Vista Point, it appears from the NASA photographs that the outstanding poppy color was largely limited to the southeast section of the Reserve. The satellite image posted by CNN, Figure 4, confirms the limited poppy displays in the surrounding areas.

Although the media broadly talked of super blooms everywhere, the media wonks really lack historical perspective and hype helps sell newspapers, as the old saying goes. The term historic Super Blooms might truly hold for other locations like Walker Canyon (I don't have the history to judge) but I believe that the Antelope Valley has actually had better poppy displays in a few past years. I would say that this year was a very, very good poppy season but not really a truly outstanding one. Having not even seen this spring's wildflower displays



at their peak, I might be overstepping my right to make these conclusions. I'm open to hearing your view of this spring's poppy displays.

A



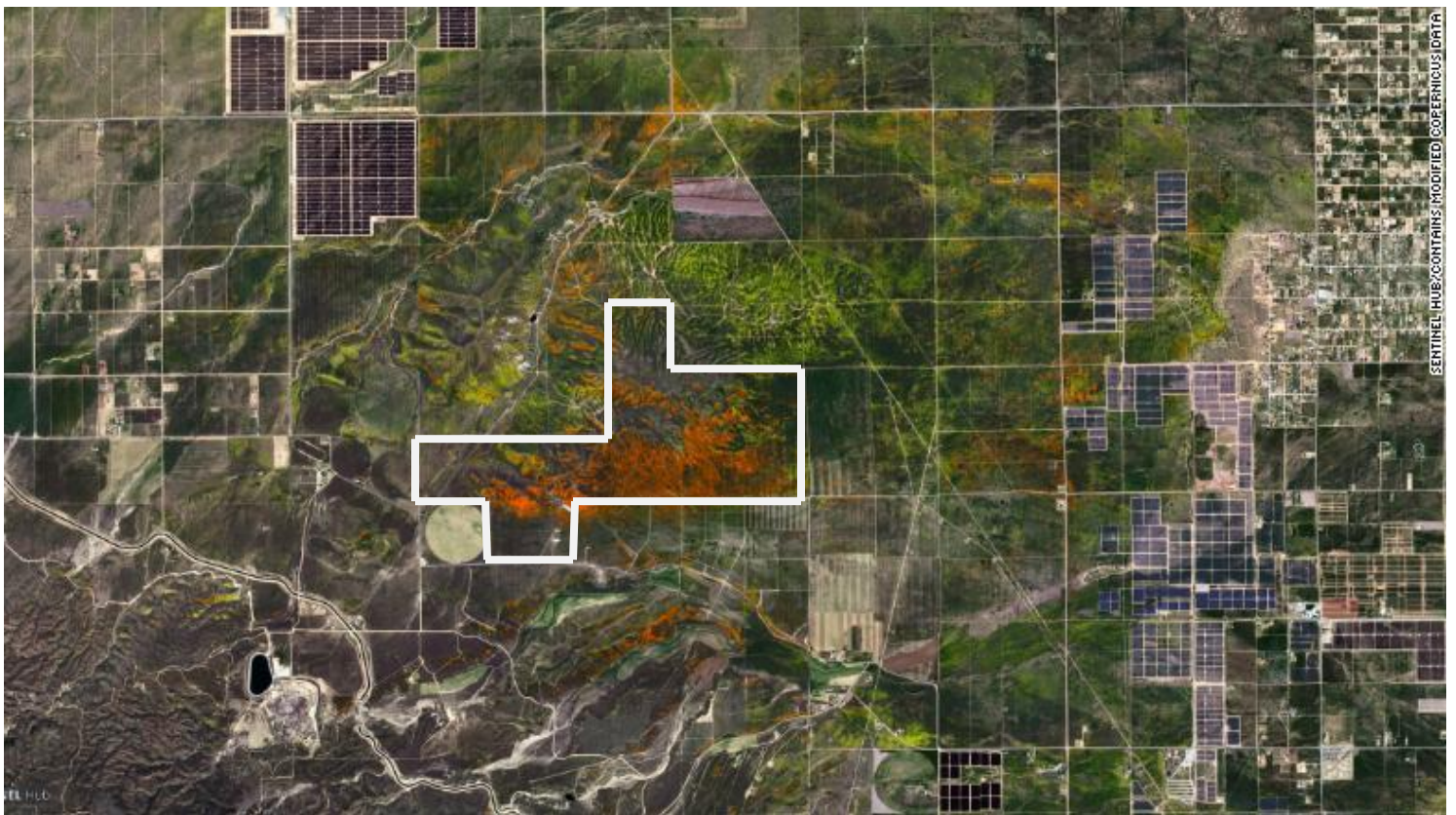
B







**FIGURE 3 A,B&C: POPPY RESERVE AERIAL PHOTOGRAPHS TAKEN 2 APRIL 2019**

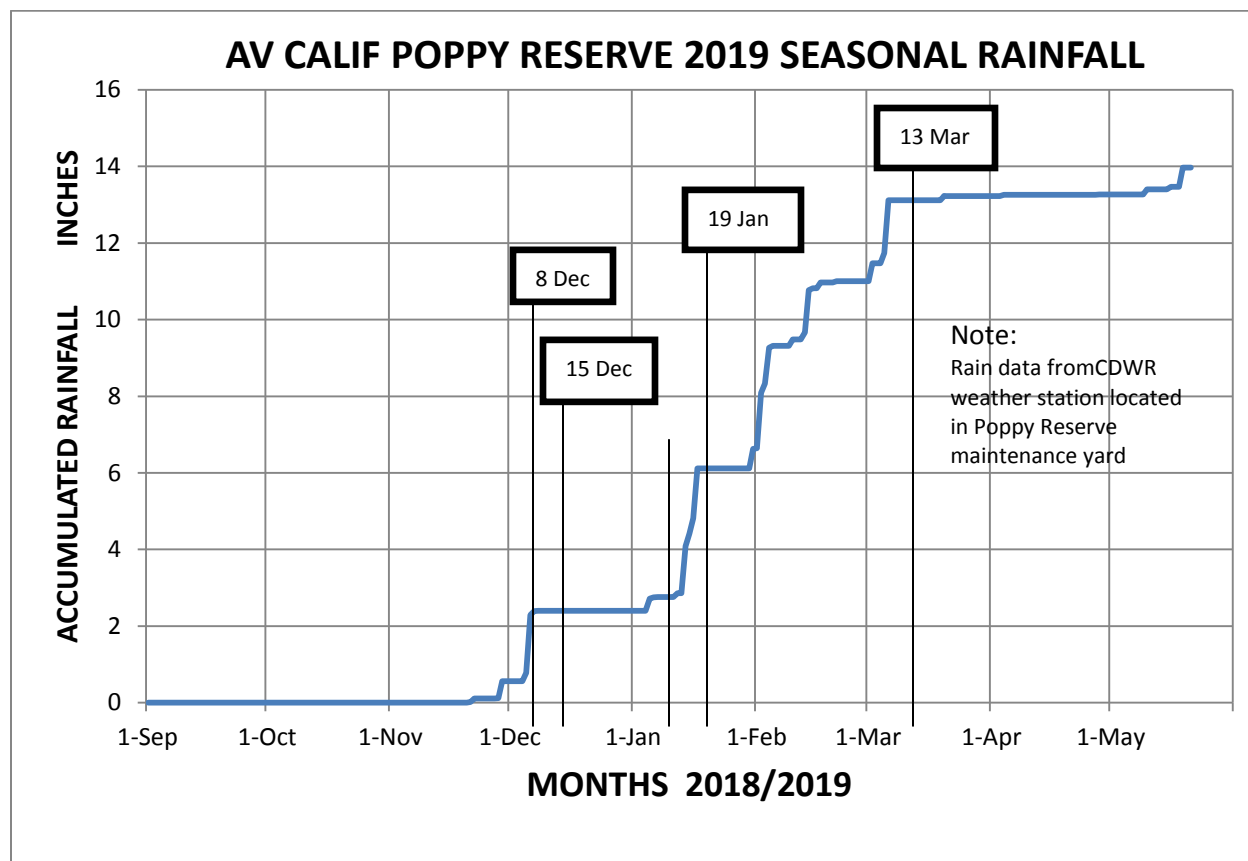


**FIGURE 4: CNN SATELLITE IMAGE OF POPPY RESERVE TAKEN 30 MARCH 2019**

Even though there are several interesting stories hiding in the photographs in Figures 3B&3C, I am running out of time to prepare this article and need to move on to a couple of other topics so these intriguing stories will have to wait for a future posting.

From the very beginning to the end, this has been a humbling season for me because it has challenged so many of the “field observations” based conclusions I have made on how various weather parameters affects the spring wildflower displays. I’ll describe a couple of examples but, first, a quick summary of how the winter weather unfolded.

As shown in Figure 5, the Poppy Reserve received its first rain, only 0.1 inches, on 22 Nov ’18 followed by a slightly stronger storm, 0.4 inches, on 29 Nov. Although three of the last twenty two winters also received their first seasonal rainfall in November, this winter had the latest first rainstorm by a week or more. Maybe more important for its impact on the subsequent wildflower season is when the first “significant” rainfall occurs. Of the twenty two years that rainfall data is available, seven years had their first significant rainstorm later than this winter; one as late as the second week in February. I am arbitrarily defining “significant” as 0.4 inches of rainfall from a rainstorm. Before now, I would have defined “significant” as 0.6 inches of rainfall because I believed, based on past field observations, that amount of rainfall was required to trigger any poppy seed germination. This winter’s data is challenging that conclusion; more on this topic a little later in this posting. The later seed germination means the wildflower season got off to a later start and that can, depending on the total seasonal rainfall, result in a later peak poppy color. I have been told by the other volunteer researchers that they believe the season peaked in mid-April or later so this year’s color peak was indeed several weeks later than the more typical late March peak in poppy color.



**FIGURE 5: AV POPPY RESERVE 2018/2019 SEASONAL RAINFALL**



Past field observations have shown that newly germinated poppy plants can normally last for four or five weeks without additional rainfall with high survival rates but longer dry periods result in the young poppy plants starting to die off. Until mid-March, the longest dry period this winter was four and a half weeks through December and the dry period followed a strong rainstorm that deposited 1¾ inches of rainfall so I suspect that almost all the germinated poppy plants survived and produced blossoms. After that one extended dry period, the remaining winter was a series of closely spaced rainstorms.

Besides the rainfall amount of individual rainstorms and timing between rainstorms, the seasonal total rainfall has also had a profound effect on the quality of that spring's wildflower displays but more is not necessarily better or even needed. For outstanding poppy displays, there needs to be enough moisture stored in the soil to allow the poppy plants to grow uninhibited well into the spring. This results in larger plant sizes with more open poppy blossoms leading to better poppy color. The wildflower season of 2003 can help answer the question of how much total seasonal rainfall is needed to provide adequate soil moisture levels.

It might be because the spring of 2003 was when I started to volunteer at the Poppy Reserve but I consider spring 2003 had one of, if not the best, poppy displays I have personally experienced. As seen in Figure 1, the winter/spring of 2002/2003 had 9¾ inches of total seasonal rainfall and it resulted in outstanding poppy displays so, apparently, less than ten inches of total rainfall is needed to provide the required soil moisture. A former locally based State Parks ecologist provided some data that a seasonal rainfall of between 7 and 8 inches resulted in what he considered good poppy displays. In any case, this winter/spring with its total rainfall of 14 inches should have resulted in more than adequate soil moisture and the resulting likely larger poppy plants with their more numerous blossoms could have contributed to this spring's outstanding poppy displays. It should be noted that there were late season rainstorms depositing significant rainfall in March, April and early May 2003 and open poppy blossoms continued to be found into mid-July of that summer so I would expect that poppy blossoms will be found later than typical this year also.

In past winters, the researchers have observed cases where extreme, both hot and cold, winter temperatures have adversely effected the following wildflower season. California poppies are a known frost tolerant plant species so they are adapted to surviving the Reserve's freezing night times as long as the days typically warm up. The researchers have commonly observed poppy plants survive night time temperatures as low as 5 °F with only the loss of some leaf stems. It is only during extreme cold snaps where the day time air temperatures are only slightly above freezing that the measured soil temperatures are below freezing. Almost all the Reserve's plants species are killed if the soil freezes. This phenomenon has been observed in one or two winters since 2003.

During winter/springs with limited total seasonal rainfall, large plant die-offs have been observed when the early March temperatures have been unseasonably hot, 90 °F instead of the more typical low 70's, for an extended period. The double whammy of limited soil moisture and high temperatures apparently are too much for the normally hardy poppy plants.

Fortunately, neither extremely cold nor hot temperatures occurred at the Reserve this winter so their adverse affects did not result in large poppy plant loss thereby degrading the poppy displays. The longest period of freezing night time temperatures occurred in early January but the maximum day time air temperatures were close to, or above, 50 °F during that period. The warmest day time maximum air temperature recorded between mid-February and mid-March was 73 °F. Besides, this winter's abundant total seasonal rainfall should have largely neutralized the impact of any warm temperatures.

This posting has mentioned several times how the results of our field observations this year are challenging some of my previous held conclusions on how climate affects the quality of the poppy displays. My previously held conclusions are based on seventeen years of field observations as well as the Reserve's rainfall and temperature data going back to 1997. I'll describe two observations that are total mysteries at this time.

The first anomalous observation occurred after the first seasonal rainstorms. The vertical lines and boxed dates on Figure 5 show the dates that the volunteer researchers visited the Poppy Reserve to inventory established



monitoring plots. A number of these one meter square marked off plots were established at different locations on the Reserve at the beginning of the field observation effort and allow the researchers to document how many poppy plants are growing in different sections of the Reserve. Repeated inventorying of the plots through a season allows the researchers to document the number of poppy seeds that germinate following each rainstorm and the survival rate of the subsequent growing young poppy plants. The dates shown on Figure 5 were intentionally selected based on expectations from past observations. The first stage of poppy seed germination is the beginning growth of the root system which, because it is underground, is not observable. The first indication a seed has germinated is the emergence of the plant's cotyledons. Typically, poppy cotyledons emerge seven to ten days after seed germination is triggered. Because the cotyledon for each plant species is different, each plant can be identified even at this stage of its development. A week or two after the cotyledon emerges the plant's first true leaf starts to develop and the cotyledon, having done its job, starts to die.

On 8 Dec '18, nine days after the 29 Nov rainstorm but only two days after the next storm on 6 Dec '18, the monitoring plot near the Reserve's Visitor Center was inventoried and recently emerged cotyledons of poppies, filaree, fiddleneck and pygmy-leaved lupine were found and marked with plastic toothpicks so they could be tracked during subsequent inventories. Because this visit was only two days after the 6 Dec '18 rainstorm, all of the documented cotyledons had to have come from the 29 Nov '18 storm. This storm deposited less than a total of 0.6 inches of rain so, based on past season observations, few if any poppy cotyledons were expected to be found. Instead, a limited but unexpectedly large number were. Again, based on past observations, the seeds of filaree and other plant species appear to germinate in drier soil conditions than poppy seeds so finding filaree, fiddleneck and p-l lupine cotyledons was not a total surprise like the poppy cotyledons.

During the next visit, 15 Dec '18, the monitoring plot on the east ridge of the Reserve was inventoried. Because it is now nine days after the 6 Dec '18 rainstorm, just emerging poppy cotyledons were expected to be found. With only 0.33 inches of rainfall recorded on the east ridge from the 29 Nov '18 storm, no poppy cotyledons from that storm were expected to be found in this monitoring plot. Instead, 50 to 100 mature, full sized poppy cotyledons were found. Either this many poppy seeds germinated in much drier soil than expected or the poppy cotyledons emerged only a day or two after the 6 Dec '18 storm giving them time to mature and grow to full size. Neither possibility seems a reasonable explanation for this poppy seed germination mystery.

The second mystery is why were the best poppy displays limited to the Poppy Reserve this year and off the Reserve in other years? This year's demarcation is so clear in Figure 4. If climatic factors are the primary influence on each year's quality and location, as I have been assuming, it's unlikely that the demarcation would be sharp. The Reserve's boundary fence line has little impact on the rain or temperature patterns. Maybe, someone is secretly grazing animals on the Reserve or the Reserve's elves have been out spreading fertilizer on the east ridge slopes.

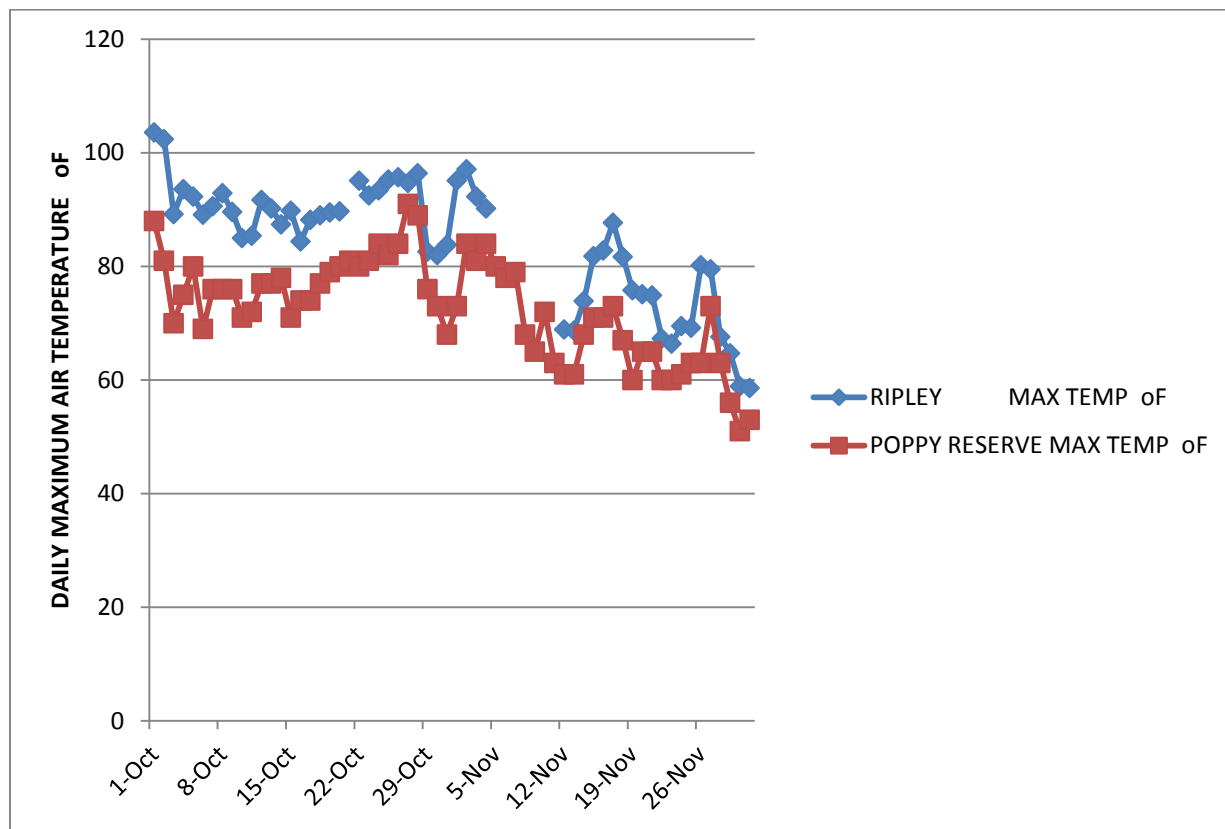
With three California State Park facilities located relatively close together in the Antelope Valley, the volunteer researchers have been wanting to exploit this somewhat unique opportunity for a number of years. These three State Park Facilities, Arthur B. Ripley Desert Woodland State Park, the Poppy Reserve, and Saddleback Butte State Park, all have substantially different vegetative communities. If the climates at all three facilities were known, it might be possible to determine the range of climatic conditions the Parks' various plants species are currently adapted to. For example, goldfields grow profusely at all three Parks. With Saddleback Butte Park having warmer summers, colder winters and much less rainfall, this species must be adapted to a wide range of climatic conditions. On the other hand, linear-leaved goldenbush grows profusely at Arthur B. Ripley Park but there are only three plants of this species known to be growing on the Poppy Reserve, only seven miles away, so this species must be adapted to much narrower climatic conditions. This type of species adaptability data could be very useful to researchers studying and predicting the impact of Global Warming.

California Department of Water Resources weather stations, accessible through the internet, are located on both Saddleback Butte and the Poppy Reserve but the lack of a weather station located on Arthur B. Ripley Park have prevented the volunteer researchers from both proceeding with, or advocating for, this type of study. Because, unlike the Poppy Reserve where the visitors are restricted to staying on the trails, visitors have fully open access to Arthur B. Ripley Park (visitors can walk anywhere), the researchers have been reluctant to establish a weather station using the same expensive equipment used for the Poppy Reserve mini-weather stations due to the

possibility the weather station equipment could be discovered and stolen. Last autumn, this potential problem was resolved when Bob Waidner, a relatively new Poppy Reserve volunteer researcher, was aged to visit Arthur B. Ripley Park once a week or so to collect the recorded temperature data. This allowed available low cost temperature recorders to be used in place of the more expensive digital data recorders. Bob was also willing to go to Arthur B. Ripley Park after each rainstorm to record the collected rainfall and empty the rain gauge.

The new weather station at the Arthur B. Ripley Desert Woodland State Park has been collecting weather data since 1 Oct 2018 so we now have one full season of comparable data. This weather station consists of a collection rain gauge and a temperature recorder with two probes; each probe recording daily maximum and daily minimum temperatures. One recorder probe measures the daily maximum and minimum air temperatures and the second probe is buried in the ground to measure the near-surface daily maximum and minimum soil temperatures. With me being laid up for several months, the researchers are just starting to analyze the collected data so the data in the figures shown below should be considered preliminary because we are still in the midst of sorting out some unexpected results and apparent anomalies in the data.

Figure 6 shows the comparison of the daily maximum air temperature between ABRDWSP (Ripley) and the equivalent data recorded at the Poppy Reserve. Because the temperature recorder being used at Ripley has very limited memory capacity (7 days), there will be a break in the Ripley data as shown for the Ripley data if the researcher is unable to go weekly to collect the data.



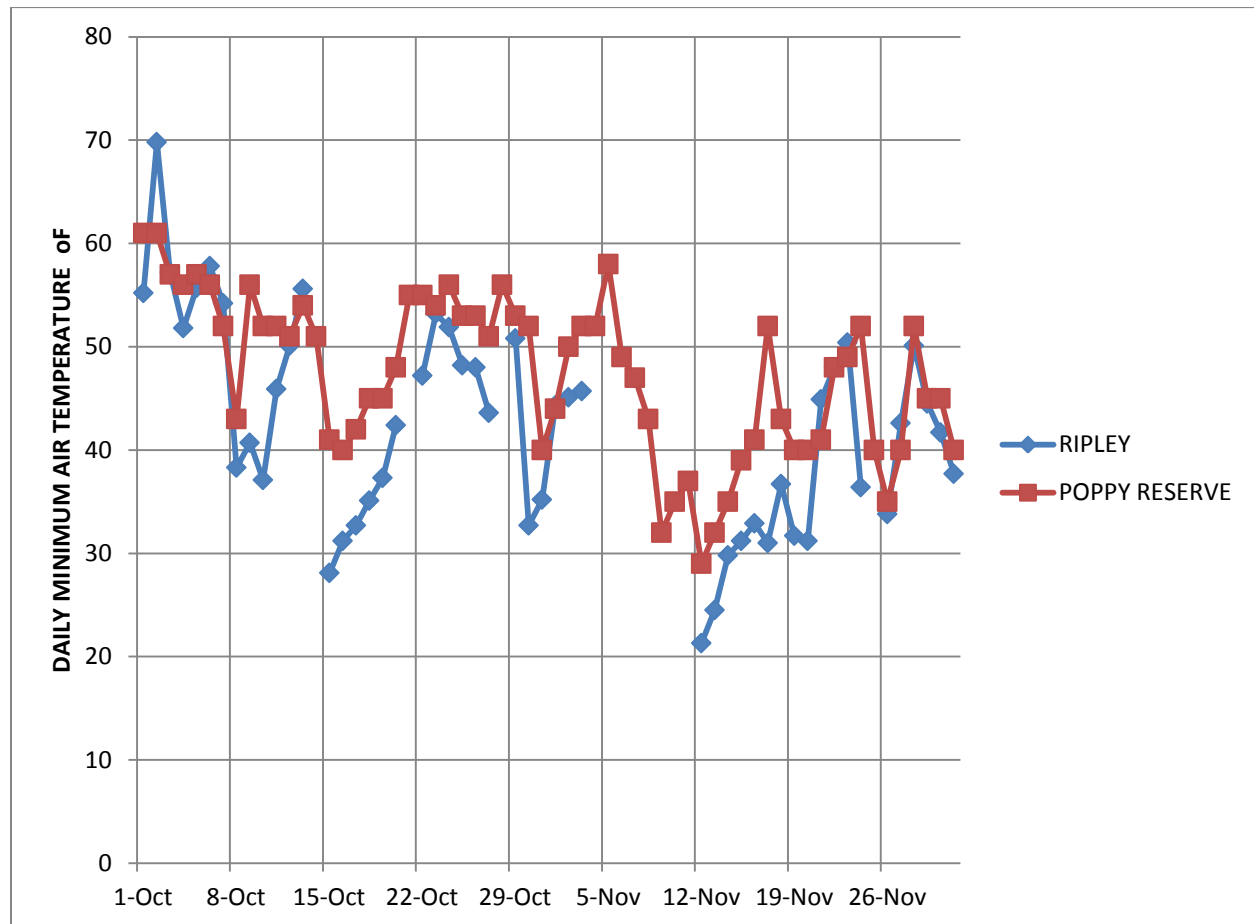
**FIGURE 6: COMPARISON BETWEEN RIPLEY AND POPPY RESERVE DAILY MAXIMUM AIR TEMPERATURES**

Figure 6 shows Ripley's daily maximum air temperature is consistently warmer than the Poppy Reserve. Because Ripley is at a slightly higher elevation and closer to the mountains, this warmer temperature difference is unexpected and we are not sure if this data is valid. The researchers are currently investigating possible explanations for this difference. It is possible that the observed temperature differences are due to differences in the two weather stations' mounting configurations. The temperature probe at the Poppy Reserve' weather station is located quite high; approximately ten to fifteen feet above the ground. In contrast, the Ripley air temperature probe is mounted only ten inches above the ground. This was done intentionally because our research objective



is to measure the temperature environment that the poppy plants and other smaller plants experience. It is known that the earth has what is called a thermal boundary layer close to the ground surface. The air temperature is warmest at the sun warmed soil surface and decreases further from the ground. Because the Ripley air temperatures are warmer than those measured at the Poppy Reserve, it is possible that the observed difference is due to the earth's thermal boundary layer. The researchers are currently installing additional temperature recorders to actually measure the thermal boundary layer in greater detail to investigate this possibility.

Figure 7 shows the equivalent data for the recorded daily minimum temperatures at the two State Parks.

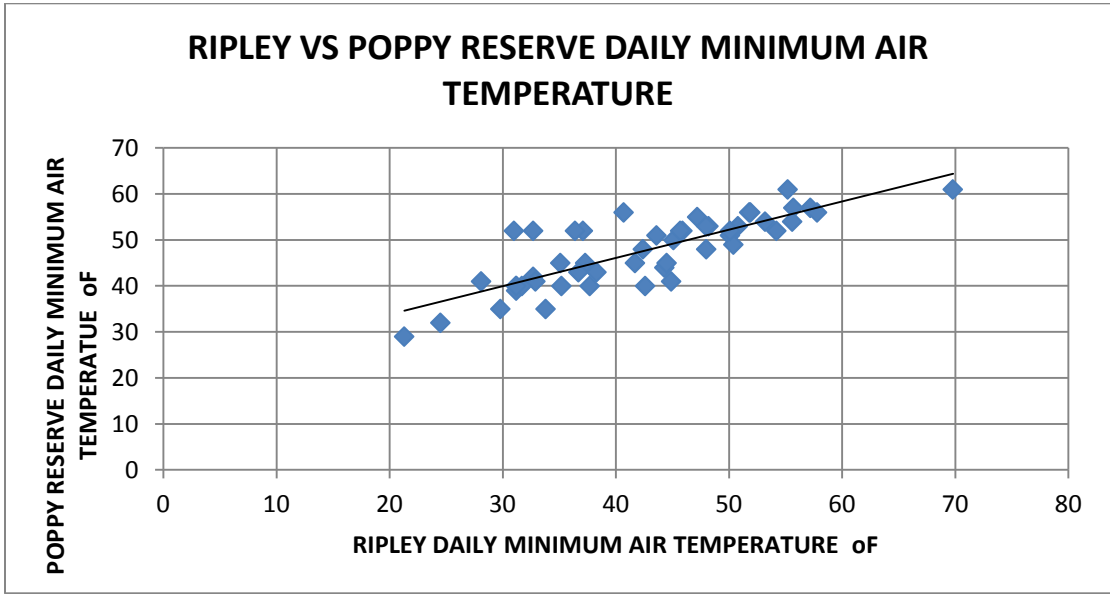


**FIGURE 7: COMPARISON BETWEEN RIPLEY AND POPPY RESERVE DAILY MINIMUM AIR TEMPERATURES**

In contrast to the daily maximum air temperatures, Ripley's daily minimum air temperatures are consistently lower than that measured at the Poppy Reserve. This trend is more expected but the recorded data could still be being influenced by the earth's thermal boundary layer which still exists at night even though the soil is not being actively warmed by the sun radiation. Because the earth has a greater thermal mass, it cools slower than the air and therefore maintains the thermal boundary layer.

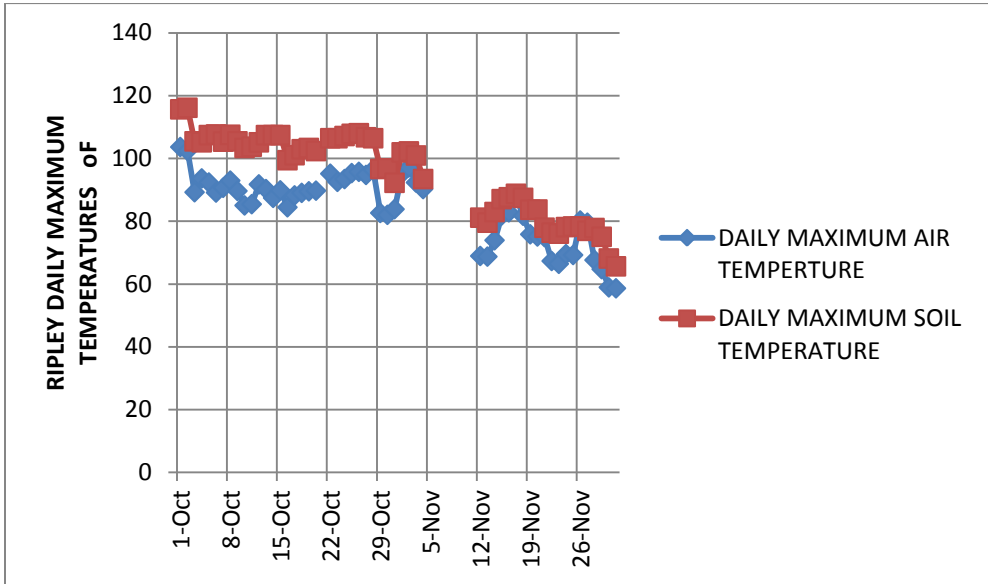
The same minimum air temperature data can also be plotted differently; plotting the Ripley daily minimum air temperatures directly against the Poppy Reserve's equivalent minimum air temperature as shown in Figure 8. Plotting the data this way shows more clearly that Ripley has a bigger variation in daily minimum temperature than the Poppy Reserve. For example in Figure 8, the "best fit" trend line would predict that the Poppy Reserve minimum temperature would be only about 64 °F when Ripley's minimum temperature is 70 °F but, when Ripley's minimum temperature is 30 °F (slightly below freezing), the Poppy Reserve's minimum temperature would be expected to still be above freezing at a "balmy" 40 °F. If this data is correct, it means that Ripley would have more freezing nights than the Poppy Reserve

Again looking at Figure 7, this trend can be observed at the colder temperatures. By the end of November, Ripley had eight to ten nights below freezing compared to only one night at the Poppy Reserve and the Ripley minimum temperatures were much colder; already as low as 21 oF. This more severe night time temperature environment might prevent less frost tolerant plant species from growing at Ripley but still be adapted to Poppy Reserve's less severe night time temperatures. Fortunately, California poppies are frost tolerant. In fact, poppies have been studied to determine what characteristics make a plant species frost tolerant.



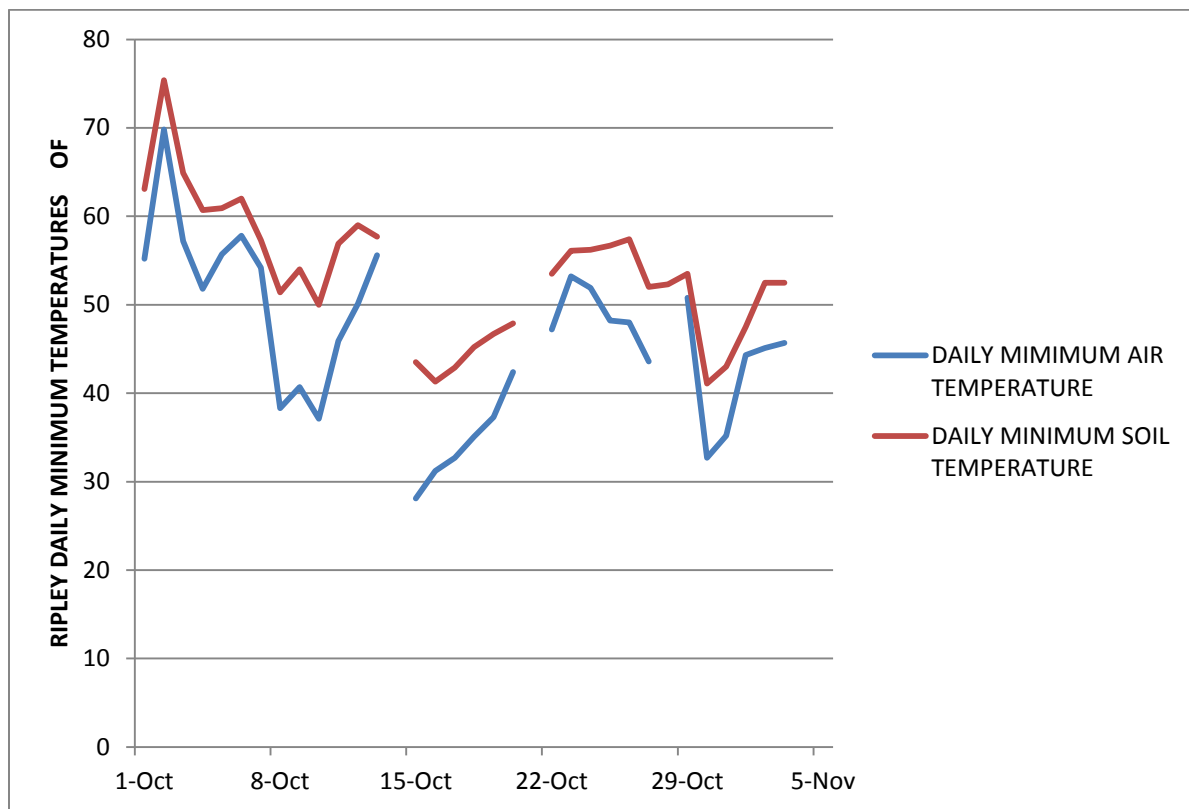
**FIGURE 8: RIPLEY VS POPPY RESERVE DAILY MINIMUM AIR TEMPERATURE**

Because soil temperatures are not currently being recorded at the Poppy Reserve, we can only report soil temperature data for Ripley, shown in Figures 9 and 10.



**FIGURE 9: RIPLEY DAILY MAXIMUM AIR AND SOIL TEMPERATURES**





**FIGURE 10: RIPLEY MINIMUM AIR AND SOIL TEMPERATURES**

More results will be reported in future postings as the Arthur B. Ripley weather data is further analyzed.

Mary Wilson, in her Sept '18 "Field Observations" article posted on this same website, gave an informative description of the grasshopper species frequently found on the Reserve. I enjoyed reading Mary's article and found the information fascinating. I would encourage everyone to read Mary's "Field Observations" because she reports on what is happening at Arthur B. Ripley Park, the Poppy Reserve, other good wildflower locations and, as well, the colony of burrowing owls that have been located on the Poppy Reserve.

Mary's September article reported that grasshopper species are approximately 300 million years old. Well, grasshoppers are not the only 300 million years old species found on the Reserve; there's at least one other species that old. Because they are so closely associated with watery environments, I am always surprised when we infrequently, but consistently, have the good fortune to see dragonflies on the Reserve, see Figure 11.

Being surprised by continuing to see dragonflies on the Reserve caused me to research this insect species a bit and found their story fascinating and amazing. Where to begin describing what I learned? First, dragonflies are believed to be one of the first known flying insects. Dragonfly fossils are found in rocks dated to more the 300 million years old. There are more than 5000 known species of dragonflies and they are found worldwide; on every continent including Antarctica even though dragonflies are cold blooded insects. They might be so widely found because 300 million years ago was so long ago that there was only a single supercontinent. This was before the supercontinent, called Pangaea, started to break up to eventually form all the different continents we know today.



**SEPT 9 2017**



**NOV 11 2018**

**FIGURE 11: DRAGONFLIES OBSERVED ON THE POPPY RESERVE**

Dragonflies have four wings; each can be independently moved giving the dragonfly the ability to fly in any direction – forward and backward, up and down, as well as sideways left to right and even upside down all at speeds up to 30 mph. Dragonflies are generalized carnivores; taking their prey totally while flying. Prey consists of flies, bees, wasps, moths, butterflies, mosquitoes, grasshoppers and even other dragonflies; really anything that flies and is small enough to grab. Their flying agility makes the dragonfly the world's most efficient hunter known of all animals. In controlled experiments, dragonflies catch their prey up to 95% of the time. In contrast, lions and other large carnivores catch their prey less than 50% of the time. One reason for their hunting success is because they focus on a single selected prey and then tracks the prey's flight path. Rather than aiming for the prey and chasing it, they calculate where the prey will be in the future and aims for an intersect point. This reminds me of an old fashion airplane dogfight. The pilot doesn't aim at the target airplane but in front of the



plane so the target plane flies into already shot bullets; the bullets and target plane gets to the intersect point at the same time. If the prey changes their flight path, the dragonfly instantaneously recalculates a new intersect point and changes their flight path accordingly. Once a prey is selected, the prey doesn't stand much of a chance to get away. Dragonflies are also known for their ravenous appetite. It has been reported that they can eat 100s of mosquitoes each day; hopefully, dragonflies are around here in Long Beach. In one controlled experiment, 31 flies were released into the dragonfly's enclosure and the dragonfly ate all of the flies one after another until they were all gone [and the dragonfly probably begged for more].

The dragonflies' keen eyesight also contributes to their hunting success. Most of their head is eyes. Dragonflies have compound eyes made up of more than 30,000 individual eyes; kind of like the cone blossoms of plant species in the sunflower family. Dragonflies are widely considered to have the best eyesight of any animal on earth. Because of their large compound eyes, dragonflies can see in all directions around them except directly behind them.

Some dragonfly species migrate and one species holds the record for the longest migration distance of any insect; 11000 miles across the Indian Ocean and back. Another species flies from Libya to Iceland in only four days.

Based on the description and photographs contained in "Dragonflies of California ..." by Kathy Biggs, this dragonfly has been tentatively identified as a female Variegated Meadowhawk. It is a dragonfly, and not a damselfly, because of its heavier body and, more telling to me, its wings remain extended while resting; damselflies fold their wings back along their bodies when at rest. Variegated Meadowhawks have "unique Porthole-like spots low on the abdomen" and bi-colored patterns near the wing tips. It is a female because the male has a much more reddish color pattern.

Because dragonflies are associated with watery environments, why are dragonflies ever seen on the desert grassland Reserve? There are several possible answers. First, Variegated Meadowhawks are one of a few dragonfly species that annually migrate so the observed dragonflies could be migrating individuals. Northern population adults that emerge from aquatic larvae in the spring time will migrate south, as far south as Honduras, while some southern adults that emerge in the fall will migrate north before breeding; adult dragonflies live for a few months. The second possible answer is that the observed dragonflies are part of the southern populations that live and breed in place.

The University of Alabama Museum's sponsored OdonateCentral website, a central data collecting website for all things dragonflies and damselflies, lists sightings of Variegated Meadowhawks at both Apollo Park and Edwards Air Force Base's Piute Lake; a good 15, or more, miles away. Because dragonflies are known to travel miles searching for food, it's possible the Reserve's observed dragonflies are local population members coming to the Reserve for a late lunch before going home to water. With the Variegated Meadowhawks being long distance travelers, it shouldn't be that surprising to see dragonflies on the Poppy Reserve; even fifteen miles is a short hop, skip and jump from Piute Ponds, if that is where they come from.

If my short sharing about dragonflies has piqued your curiosity enough to want to know more about this amazing insect, I obtained most of my information from the great, 50 minute documentary titled "Sky Hunter, The World of the Dragonfly" that is posted on YouTube on the "Secrets of Nature" channel. Additional information was also obtained from the short, YouTube Smithsonian channel video titled "14 things about dragonflies" and, of course, Wikipedia along with a few other short videos on YouTube. Good Watching!!!

I'll end with again encouraging everyone to visit the Reserve during the off-season months. You can frequently find at least one species blooming on the Reserve every month of the year, except maybe late December. Even if you don't find any blossoms, there is always the potential that you will experience your own "magical" moments and that is worth the trip unto itself.

I always welcome your comments and feedback on my postings. If you are so inclined, I am open to reading your reactions to this spring's wildflower season, the length of my postings, the topics I discuss as well as anything else you are willing to share. My email address is [mfpowell@verizon.net](mailto:mfpowell@verizon.net).