REPORT FROM THE FIELD
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With
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The readers of this posting are likely to already know that the Poppy Reserve's spring wildflower season was very poor following the second driest winter/spring rainy season in the last twenty four seasons as can be seen in Figure 1. The driest winter/spring was in 2012/2013 with only 1.4 inches of total rainfall but the winters/springs of 2001/2002 and 2006/2007 were not much wetter. The vertical red line is the average seasonal rainfall, just slightly less than seven inches per season, over the last twenty four years.

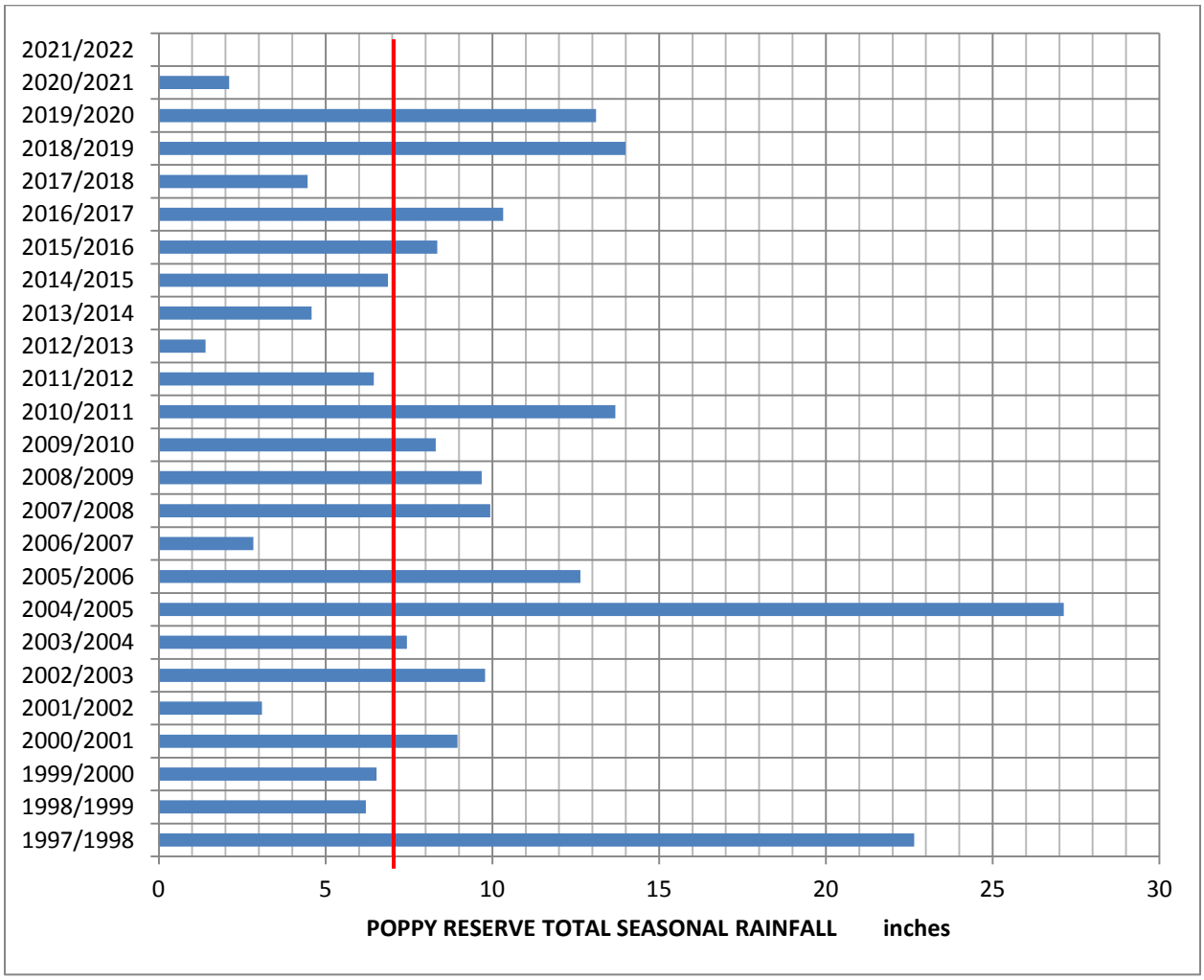

FIGURE 1: POPPY RESERVE SEASONAL RAINFALL

The most obvious observation of the seasonal rainfall pattern is the extreme variability of the rainfall the Poppy Reserve receives each winter/spring. This wide rainfall variability forces the various plant species found growing on the Reserve to adapt complex survival strategies.

The seeds of some plant species are adapted to stay viable, but dormant in the soil, for multiple years waiting for just the right amount of rainfall to finally germinate, grow and reward the visitors with their blossoms. The owl's clover is one such example. Visitors to the Reserve might have to go tens of years before seeing many of these purple blossoms because the seeds of this plant species appear to require a very wet winter before seed germination is triggered. The Poppy Reserve volunteer researchers don't know if the strength of individual rainstorms or the seasonal total rainfall is most important factor affecting these displays.

Goldfields seem to have adopted a different strategy. Because dense displays of goldfields are found on both the west and east sides of the Antelope Valley, it appears the seeds of this species will readily germinate under a very wide range of soil moisture conditions. Saddleback Park, fifteen miles east of Lancaster and 30 some miles from the Poppy Reserve, still can have impressive spring displays of goldfields even though this State park typically receives only a third to half the total seasonal rainfall of the Poppy Reserve and its surrounding area; it received a total of only 1.24 inches of rainfall this year. Although the Poppy Reserve did see a few, scattered goldfield blossoms this spring, the slightly over two inches of rainfall the Reserve received this winter is not that uncommon for Saddleback Park so it is possible that the lack of goldfields at the Reserve indicates that these two populations of the same plant species have separately adapted to their local climatic conditions. It's even possible that goldfields seeds collected at the Reserve will not germinate and grow under Saddleback Park rainfall conditions; pointing out the true complexity of Mother Nature.

Although we speak of this plant species or that plant species with the implication that a species is universally all the same, the truth is that each different population of a plant species is actually near-optimally adapted to its specific environmental conditions resulting in subtle variations in the plants of different populations. I have been recently told that populations separated by as little as a quarter mile can have genetic differences. This distance is actually determined by the characteristics of the plants' specific pollination vector. For example, if a plant is pollinated by an insect, the typical range of that insect species as its members carry pollen from one plant to another determines how far apart different populations have to be to begin showing genetic differences. The typical range of a bird or butterfly or bee is probably quite different than the range of a tiny soft-winged flower beetle.

From our field observations, poppies appear to have adopted a third strategy. The field observations have led us to conclude that each poppy seed is genetically set to only germinate under a limited range of soil moisture conditions and the proportion of seeds so set for a specific range of moisture conditions varies by some type of a normal distribution curve. Therefore, the amount of poppy seed germination is determined primarily by the strength of the season's individual rainstorms and not the total seasonal rainfall. Plant survival and the plants eventual size and, hence, the number of dispersed seeds for replenishing the soil's seed bank, are more strongly influenced by the total seasonal rainfall.

The primary purpose of these different survival strategies is to allow the plant species to continue to be a member of the location's native vegetative community as well as successfully compete with invading non-native plant species. Long term seed dormancy until the wettest winters gives the best probability for each plant surviving to full maturity and dispersing the all important seed bank replenishing seeds. Having seeds genetically adapted to germinate under a wide range of soil moisture conditions and having seeds genetically adapted to germinate under local rainstorm patterns appear to be two successful approaches to address highly variable seasonal rainfalls.

I've gotten somewhat sidetracked so back to discussing this spring's wildflower season. Because of the poor displays this spring, it might initially be concluded this was a lost year but, in some ways, this spring provided a unique opportunity to expand the knowledge about the California poppy as well as some of the other plant species growing on the Reserve.

Figure 2 shows the recorded rainfall amounts for each of the nine individual rainstorms that deposited rainfall at the Poppy Reserve's maintenance yard; the horizontal blue lines. The horizontal green lines mark the dates of observational visits to the Reserve. Within the constraints of COVID10 travel restrictions, the timings of these visits were specifically selected to allow the amount of poppy seeds that germinated as a result of each rainstorm to be documented; especially in the three permanent monitoring plots currently being maintained. Ideally, a visit would have been scheduled ten days, or so, following the late December rainstorm but the travel restrictions imposed due to the winter COVID19 surge prevented any travel in early January 2021. The impact of this travel restriction was not severe because we felt confident that differences in stages of plant development would allow us to distinguish between poppy plants that germinated from the late December rainstorm and the late January rainstorms during the early February inventorying of the monitoring plots.

There is one more feature on the figure that needs to be noted before discussing the results of our recent observations. The vertical red line is the approximate minimum rainfall amount, 0.6 inches, which was believed to be required to trigger any poppy seed germination. This lower limit of poppy seed germination is based on many years of field observations. We would not expect to observe any poppy seed germination following rainstorms that deposited less than the 0.6 inches of rainfall. Apparently, the soil does not become moist enough during these weak rainstorms to cause any poppy seeds to break their dormancy and begin the germination process.

During the early February Poppy Reserve visit, no young poppy plants were observed in any of the inventoried monitoring plots; neither more mature plants nor any just emerging poppy cotyledons. The lack of any just emerged poppy cotyledons was most surprising because one late January rainstorm deposited well over the minimum needed rainfall and a significant amount of poppy seed germination was certainly expected to be observed. This lack of finding newly germinated poppy plants in the monitoring plots was so surprising that other, randomly selected areas on the Reserve were also searched for signs of poppy cotyledons and these further search efforts simply confirmed the monitoring plot results. Unexpectedly, it appeared that no poppy seed germination occurred as a result of the late January rainstorm.

With a possibility that the early February visit was simply too soon after the late January rainstorm for newly germinated poppy cotyledons to have emerged, the late February visit two weeks later again focused on searching for young poppy plants. The results of this late February search effort simply confirmed the earlier visit conclusions; no meaningful poppy seed germination occurred from the late January rainstorm. Of course, this finding had a profound impact on the possibilities for the rapidly approaching spring wildflower season. Without this needed seed germination, the coming season was almost a complete certainty to be a very sparse and poor season because, if poppy seeds did not germinate from a late January rainstorm, it seemed very unlikely they would germinate from an even later rainstorm.

Although the lack of seed germination in late January was very surprising, observing missing expected seed germination was not totally unprecedented. Once or twice during past seasons, the lack of any meaningful seed germination following a late winter rainstorm which normally is strong enough to trigger a significant amount of seed germination has been observed. Therefore,

observing this as early as late January was the most surprising. If this lack of seed germination had occurred following a late February or March rainstorm, it would not have been as so unexpected. It appears that poppy seeds have a few more unexpected tricks up their sleeves. It is possible that storm timing is also an important factor for seed germination. If a storm is so late that it is likely that any resulting plant will not have sufficient time to fully mature and disperse its new generation of seeds, the seeds simply remain dormant and wait for the next winter possibilities. This phenomenon has been reported being observed in other plant species. It is interesting to note that poppy seed germination has been observed following summer thunderstorms and those young plants seemingly also have a very low chance of surviving the remaining hot and dry summer months before the autumn rainstorms finally come so there might be a difference between spring dormancy and summer dormancy for poppy seeds.

Because slightly less than 0.5 inches of rainfall was recorded for the late December rainstorm, not finding more mature young poppy plants in any of the inventoried monitoring plots during the February visits was actually expected. The surprise came later when a few poppy blossoms were observed during March and early April. With no observed poppy seed germination from the January rainstorms, the most likely storm to trigger any poppy seed germination was the December rainstorm even if no indication of seed germination was detected during the inventorying of the monitoring plots. There are several possible explanations for this. First, when only a very limited number of seeds germinate, there is a very low probability any of the poppy plants will be located in the two to three square meters making up the total area of the monitoring plots. Because it takes some effort to locate very small poppy plants, it is even possible a single poppy plant was simply missed during the inventorying. Other explanations are that there are local variations in the rainfall so some areas might have received slightly more rainfall than what was recorded at the maintenance yard or micro-contouring of the soil allowed rain to be collected and concentrated to slightly increase the soil moisture levels. Probably the most likely explanation is that the lower limit needs to be decreased to approximately 0.5 inches of rainfall, although there is little practical difference in the amount of observed seed germination between 0.5 and 0.6 inches of rainfall.

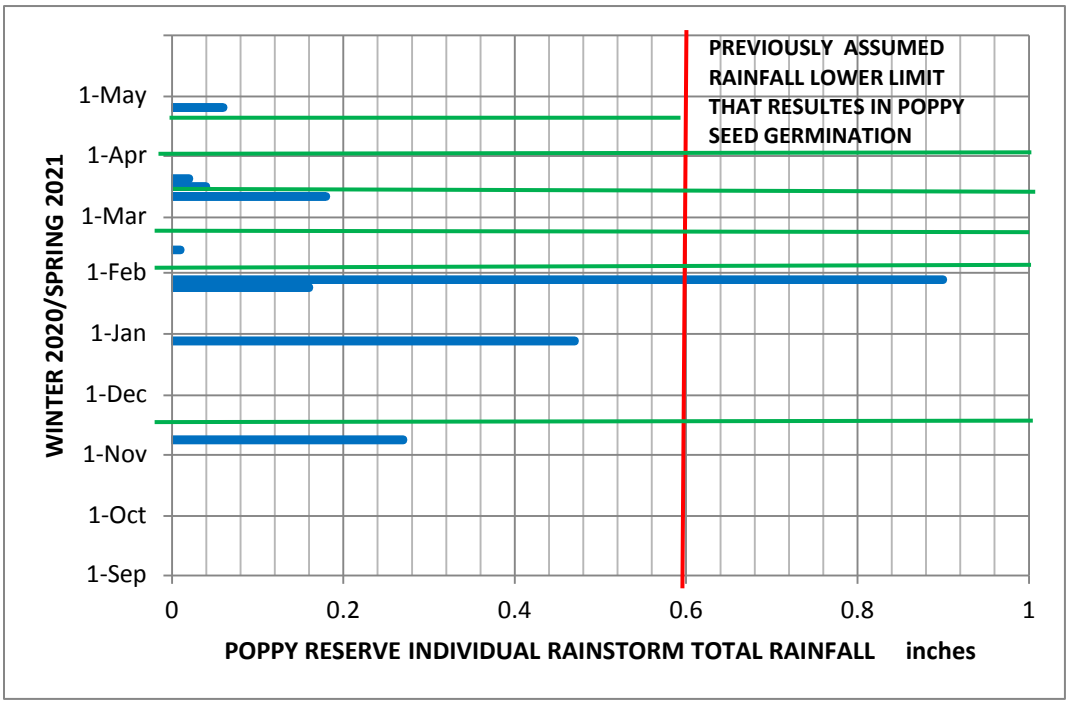

FIGURE 2: POPPY RESERVE INDIVIDUAL RAINSTORM STRENGTHS

This season also told a story about the Reserve's other plant species. It appeared this spring's most prevalent plant species was the fiddleneck. Therefore the seeds of the Reserve's population of fiddleneck plants will germinated under drier soil conditions that the other plant species giving it a competitive advantage; at least during the drought seasons. Rather than the typical tall plants with a full fiddleneck of small individual blossoms, the majority of this season's plants were only a few inches tall with only a few blossoms. Figure 3 shows an example of this season's typical fiddleneck plant with a single blossom; a somewhat extreme example but not atypical.

FIGURE 3: FIDDLENECK PLANT WITH SINGLE BLOSSOM

The desert parsley, see Figure 4, is another plant species that seemed adapted to this season's dry conditions. It is hard to call it thriving because, even in the best of season's, you have to be lucky to see a handful of these plants. Three or four plants were found this season in the two areas where they have typically been observed in past seasons. What marked them as somewhat unique is that these plants looked healthy while the plants of many other species showed obvious stress. One of the observed plants had been severely harvested earlier in the season with many of its leaf stems eaten but the plant still survived and put out several blossom clusters.

FIGURE 4: DESERT PARSLEY PLANT WITH BLOSSOM

While the list of Poppy Reserve plant species that are better adapted to drier winters is quite short, the list of plant species that were severely impacted by the lack of this past winter rainfall

is, understandably, much longer; shown by the lack of many plants that are typically seen during the more normal spring seasons. Rather than discussing the entire list, we will focus on only one; red stem filaree. Filaree is one of three or four non-native invasive species that make up a very large percent of the Reserve's vegetative community's biomass. Past observations consistently showed that filaree seeds germinate under drier soil conditions following weaker rainstorms than poppy seeds but, apparently, this species has its own limits.

Rather than the more commonly seen dense carpets of young filaree plants, only a relatively few, more scattered young filaree plants were observed this past spring; Figure 5. Even though Figure 5 is a highly enlarged, cropped section of an iphone photograph and therefore somewhat degraded, the three-lobbed filaree cotyledons and the first true leaves can still be distinguished in the figure.

FIGURE 5: YOUNG FILAREE PLANTS

This winter's lack of rainfall has the potential for multiple negative impacts on the Reserve's filaree population. With filaree being an invasive plant that competes with the Reserve's native plant species, this can be beneficial. First, only a handful of filaree blossoms or fruits were observed (see Figure 6) meaning a large majority of the few young plants did start growing didn't even reach the blooming stage before the plants died and, therefore, didn't replenish the germinated seeds in the soil's seed bank.

FIGURE 6: FILAREE BLOSSOM AND FRUIT

Potentially even more significant, it is reported that filaree seeds remain viable in the soil's seed bank for only several years. This means, if true, a large percentage of the seed bank's existing filaree seeds will have become non-viable and therefore not available to germinate during the next wetter winter.

Both effects should result in a decreased filaree population in upcoming subsequent years. Therefore, this dry winter has likely helped control this major invasive plant species.

The Reserve's other two other major invasive plant species are both annual grasses; red brome and cheatgrass. Although there is no data available on this year's relative density of the Reserve's annual grasses compared to wetter years, this spring's annual grasses looked very healthy and had already started forming seeds in early April, see Figure 7, so it seems likely that these seeds were able to mature and dispense.

A – RED BROME

B - CHEATGRASS

FIGURE 7: POPPY RESERVE'S INVASIVE ANNUAL GRASSES

During a recent visit to the Reserve, a piece of litter was noticed a short distance off the trail. When retrieved, it was a plastic pipe cap. The only reason this is being noted is because the cap was severely gnawed by some rodent along all of its edges as can be seen in Figure 8.

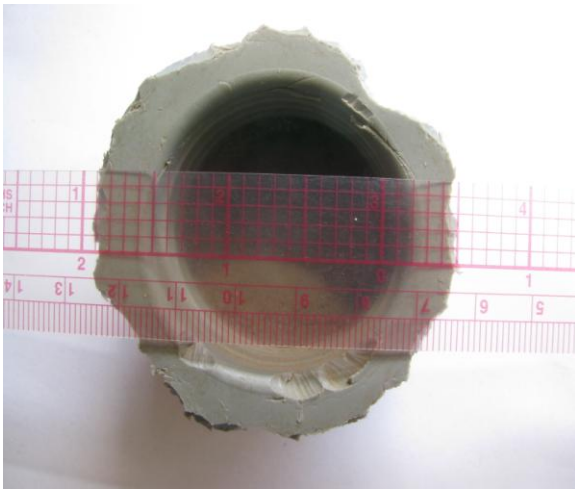

FIGURE 8: RODENT DAMAGED PLASTIC PIPE CAP

Unfortunately, this is not the first situation of rodent caused damage. Over the years, the volunteer researcher's equipment has similarly been damaged. To mention just a few examples, the upper edge of a $40 plastic rain gauge was similarly gnawed; the damage making the gauge unsuitable for further use. Unprotected sensor cabling on the researcher's weather stations have been completely severed and, likely, sections of the severed cabling taken. In one case, a soil moisture sensor buried several inches in the soil was gnawed so extensively that its attached electronics was destroyed. Because there was no ground disturbance gaining access to the buried sensor, the rodent burrowed to the sensor making a gopher the most likely suspect in this case. To help locate the permanent monitoring plots established at a number of remote locations about the Reserve, bright colored nylon cording was initially used to define the boundaries of the monitoring plots. Quite quickly, this nylon cording began to be cut and sections of the cording taken.

The researchers have had to take a number of steps to better protect their field equipment. The monitoring plots' nylon cording was replaced with wire making it much more difficult to locate the plots especially when they are located in areas of taller grasses. Exposed sensor cabling was placed in protective wire caging or, where possible, run through pvc tubing. Of course rain gauges and the weather station sensors themselves can't be protected without compromising the accuracy of the collected weather data so the periodic lost of them has to be considered part of the necessary cost of doing field observations.

Some attempts have been taken to identify the culprit rodents without success. Gnawing marks left in the plastic seem to indicate larger rodents so gophers or, possibly, rabbits are the prime suspects. In any case, clearly there is some chemical in plastic that is a very appealing attractant to some rodents.

In case you are wondering, being concerned that eating plastic could be harmful to the rodent, the pipe cap was disposed of rather than being left in place.

As always, I encourage everyone to continue to visit the Reserve throughout the year. As California hopefully continues to recover from the COVID19 pandemic, this is an especially good time to visit the Reserve to reconnect with Mother Nature.

During many years, you can see plant species blooming almost year around but this year is likely not one of them. During the most recent Reserve visit, only rattlesnake weed and mustard was observed blooming with a few turkey mullein plants seen growing.

The autumn months have some of the best weather conditions – reasonable temperatures and mild winds. If you visit early enough in the morning, the summer months can also be quite nice and, even in winter, if you add ear muffs, gloves and enough layers of clothing, it can be a bracing outing.

A quick reminder that I am open to receiving feedback on what past years readers judge had outstanding poppy displays.

If you have any questions, comments, corrections, or simply just want to say "hi", you can contact me at mfpowell@verizon.net. I always enjoy hearing from any readers. May all stay safe and healthy.