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Drought-Induced Mortality in *Malosma laurina* and *Ceanothus megacarpus* in Response to California’s Changing Climate

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**Introduction**

The research presented was conducted in direct relation to the current severe drought situation. It served to address the problem of which plants are better adapted to drought, and what these adaptations were. We hypothesized that *Malosma laurina* is better adapted to drought than *Ceanothus megacarpus* due to its adaptation of deep roots. We chose these two types of chaparral to compare their different adaptations: *Malosma laurina* having deep roots and *Ceanothus megacarpus* utilizing cavitation resistance. Our method of investigation was to study the findings of scientific journal articles and to conduct our own experiment involving the mortality of *Malosma laurina* on the Pepperdine University campus. With our experiment, we also created a sub-hypothesis, which stated that the mortality rate of the *Malosma laurina* would increase with the increase in elevation. The data collected would be compared with the data provided by Hannah Dario, in which we substituted *Ceanothus megacarpus* with *Ceanothus crassifolius* due to their similarities of genus and cavitation resistance.

**Materials and Methodology**

Putting into account that the *Ceanothus megacarpus* has been heavily affected by the past wildfires in the Santa Monica Mountains, we focused our research on the *Malosma laurina*. In order to test the water conductivity in *Malosma laurina*, we hiked the Dana Martell Trail located in Pepperdine University, an area where many *Malosma laurina* are located. Our goal in this research was to test how well the deep roots collected water despite the scarcity due to the drought. The results would reveal the power of the long tap-roots and their abilities to take in as much water as they can get. We hiked up the trail and indicated if the *Malosma laurina* was dead or still alive by tallying up the trees on our chart (Figure 2). Even if most of the tree was colorless and dead, the presence of a few branches with green leaves was enough to characterize the tree as still alive.

**Results**

The results revealed numerous facets to our research. Unsurprisingly, there were not a lot of *Ceanothus megacarpus*. Our research articles revealed before we went on the hike that the fire and drought would heavily affect this particular species and seriously damage their hydraulic function. On the other hand, the *Malosma laurina* was one of the more dominant alive plants along the trail. Though the number of this species has decreased due to fires and drought, the roots have helped to sustain its existence despite the decrease in resources.

The data also uncovered the truth in that the higher the trees were located, the more likely that they were dead, proving our sub-hypothesis. This shows that the tap roots have a harder time gathering water if they are located higher on a mountain. What was interesting, however, is the number of trees throughout the trail. There was not a huge difference between the bottom and upper half. This reveals that height is not a factor in how well *Malosma laurina* can grow. There were only eight more trees in the bottom half than the upper half.

A characteristic in the division that is not indicated in the figures is the dispersion of the trees. When we were at the bottom half of the trail, the trees were closer together. As we went higher up, the trees were more spread out and dispersed over the valley rather than bunching up around the trail as seen in the bottom half. This would require a secondary research in order to explain this phenomena.

**Abstract**

The hypothesis of this research and experiment is that *Malosma laurina* is better adapted to drought than *Ceanothus megacarpus* due to its adaptation of deep roots. This addressed the question of which plants are better adapted to drought and by which adaptations are they superior. We decided to choose these two types of chaparral due to their differences in adaptations: *Malosma laurina* having deep roots and *Ceanothus megacarpus* utilizing cavitation resistance. Our method of investigation was to study the findings of scientific journal articles and to conduct our own experiment involving the mortality of *Malosma laurina* on the Pepperdine University campus (Figure 2). It is important to note that only *Malosma laurina* was tested, because there was a lack *Ceanothus megacarpus* due to previous fires. With our experiment, we also created a sub-hypothesis, which stated that the mortality rate of the *Malosma laurina* would increase with the increase in elevation. We compared the results of the experiment to the mortality rates presented by Hannah Dario (Figure 1). Our results validated our hypothesis, and proved that the deep roots of *Malosma laurina* was the dominant plant adaptation to drought. Our sub-hypothesis was also proven correct through the data collected from our experiment (Figure 2).

**Discussion**

As displayed in Figure 1, the death rate of the *Ceanothus* plant is extremely high. This is partially because they are non-native. Unlike *Malosma laurina*, they cannot grow deep roots and always have to start over from just a small seed after a fire. Despite having the adaptation of high cavitation resistance, their shallow roots cannot supply water in a drought making this adaptation essentially ineffective. *Malosma laurina*‘s deep root offers it an escape from the effects of the drought, and it is better adapted than the *Ceanothus* plants. This adaptation only goes so far. From our data (Figure 2), the *Malosma laurina* plants are struggling in the current drought, especially the ones at higher altitudes due to the longer distance to the water tables. These water tables are also depleting, leaving many plants without a water source, which if not replenished, could affect many more *Malosma laurina* plants.

**Conclusion**

What these findings show is that progressively larger periods of drought are having effects on the plants in the Santa Monica Mountains. Even the most well adapted plant, the *Malosma laurina*, is struggling especially at higher altitudes where the water tables are farther away. If these elongated droughts continue, plants such as *Ceanothus megacarpus* and many others will become extinct. Our findings are significant, because if the drought continues and plants become extinct, it will lead to a large decrease in biodiversity throughout the mountain range. Everything in nature is connected, and this reduction in biodiversity would lead to the growth of non-native weeds and grasses, soil erosion, and possibly affecting the native wildlife. Despite *Malosma laurina*‘s superior adaptations, something must still be done to aid these plants and the others in order to preserve biodiversity. The effects of climate change are being felt, and humans are the cause of it. We must look further into the effects of CO2 on the California drought as well as do our part in reducing our emissions.

**Literature Cited**


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