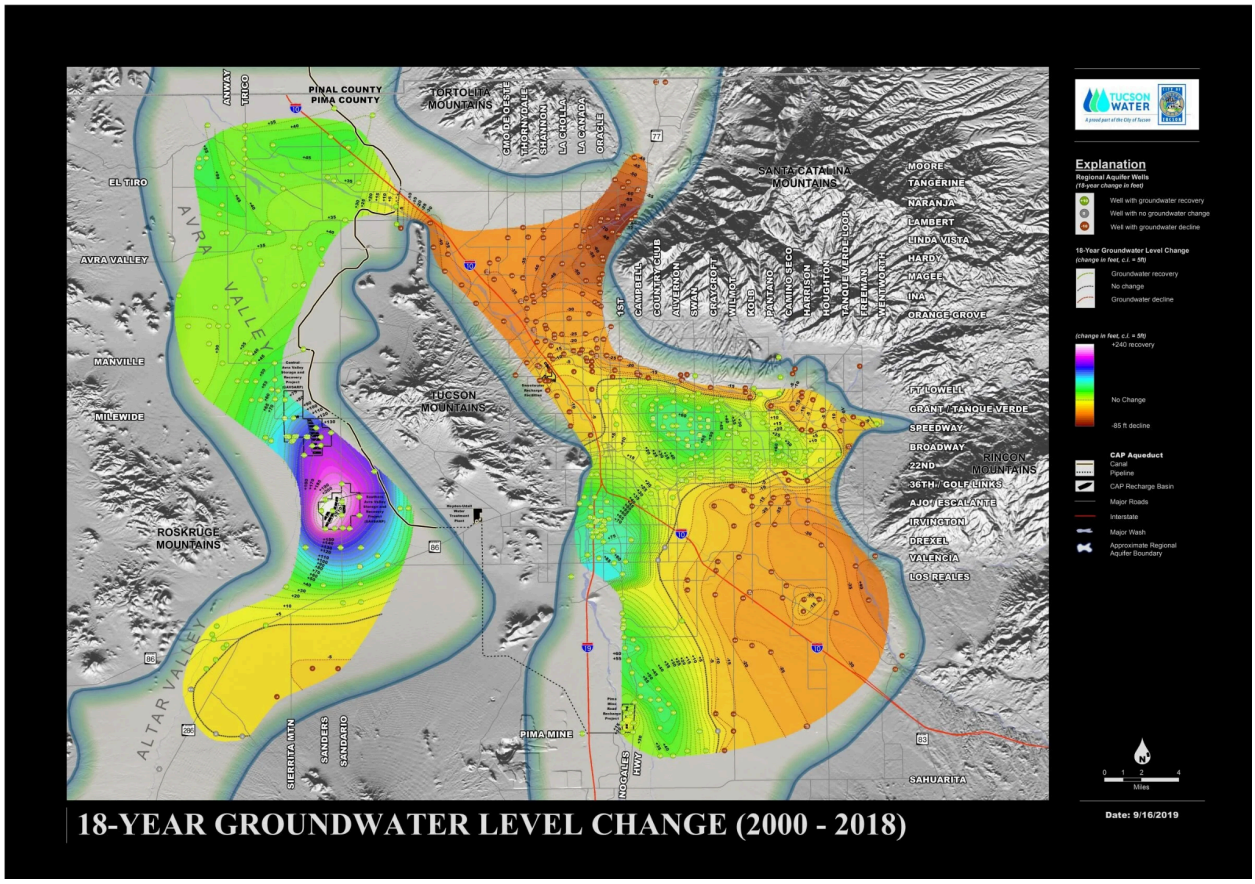
The Water-Table In a Nutshell

The question for this project is: How does the depth of the water table affect the depth of root growth in Palo Verde trees. This project is relevant to me because I want to show how the ever-decreasing water table in Arizona is affecting plants in both big and small ways and how this could have an impact in our everyday lives. Another reason I want to do this is to show how at what point do plants stop trying to grow roots in order to reach the water table and instead give up and stop. Finally, the last reason I wanted to do this is to spread awareness of the lowering water table and show how us Arizonans can combat this crisis. To develop a hypothesis, I will be researching the history of the Water Table in Arizona, the process of Hydrotopism in plants, and Palo Verde trees, their types and their needs.

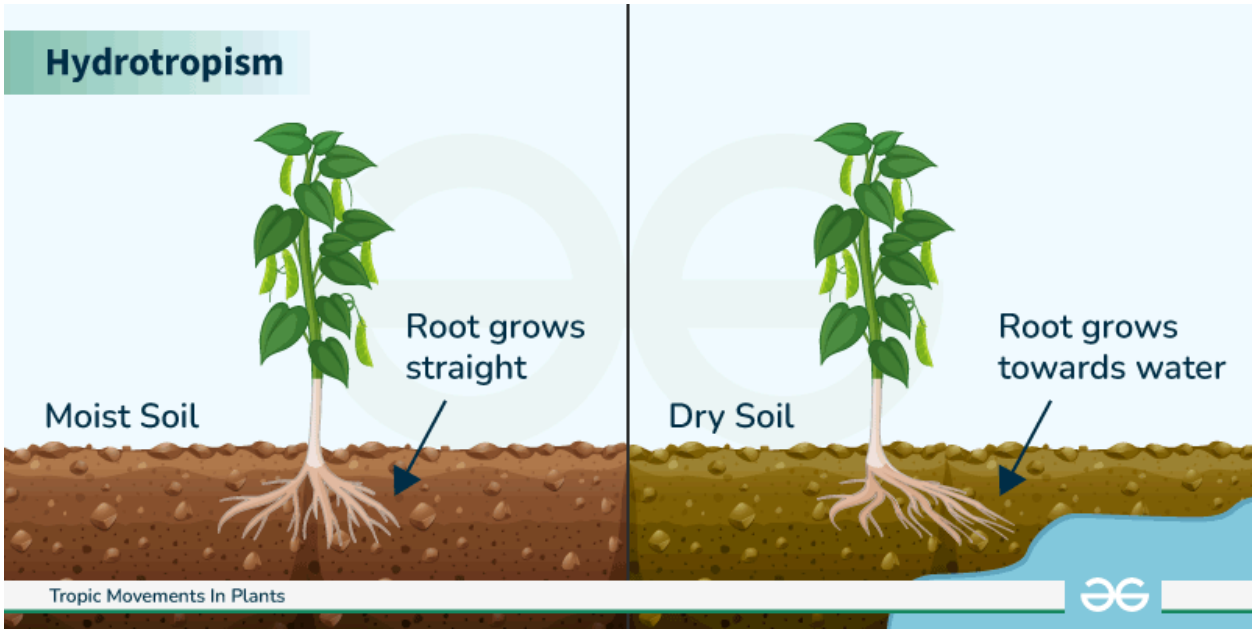
First off, the water table is the amount of water in the upper surface of the **saturated** surface where solid and rock materials are completely soaked with water. Merriam-Webster states that saturated is defined as, “full of moisture, made thoroughly wet,” (Merriam-Webster, 9/26/2025, Para 1). This is directly shown in our Arizonan water table as it has massively decreased over the years and the efforts of pumping water through the aquifers though helping but still is not stopping this crisis. This is plainly shown in the Santa Cruz river because what was once a strong powerful river is now just a dry to dusk riverbed with little to no life with only weeds and grass remaining. This can be seen in Our Memories of Flowing Rivers by the Watershed Management Group as it states, “In our watershed, there are voids in the story about the community’s connection to the Santa Cruz River and its tributaries as they responded to the decline of groundwater from the early to mid-1900s. While the decline of groundwater is part of our current recognition, the experiences of community members during this immense change is not centered in the written record,” (Watershed Management Group, Para 1, 9/12/2025). This

overall shows how the Water Table is not a forever thing instead it an ever-decreasing resource that should be treated as a valuable asset for plants and people alike.



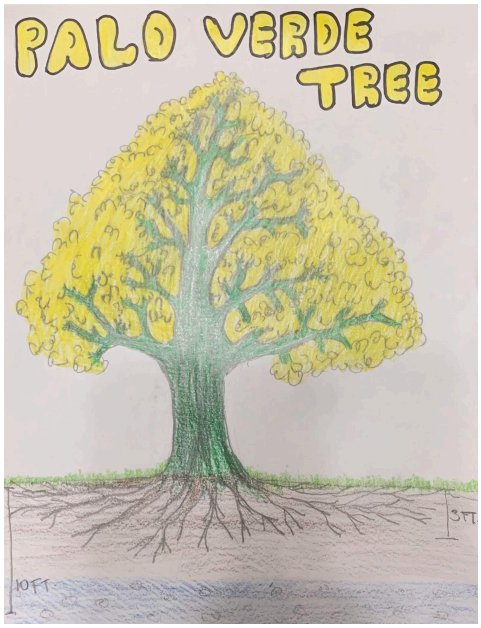
Additionally, hydrotropism is the growth of a plant's roots in the direction of **moisture**. Merriam-Webster states that moisture is defined as, “liquid diffused or condensed in relatively small quantities,” (Merriam-Webster, 9/26/2025, Para 1). This is shown in most plants across the world as when growing, plants tend to extend their roots toward the nearest water source or the water table this though is different among various types of plant species. This is shown in multiple experiments to date where they test different plant’s roots and their reactions to water while trying to limit the influence of **gravitropism**. Merriam-Webster defines gravitropism as, “a tropism (as of plants and roots) in which gravity is the stimulus,” (Merriam-Webster, 9/26/2025, Para 1). This can be seen in Molecular mechanisms mediating root hydrotropism: what we have

observed since the rediscovery of hydrotropism by Yutaka Miyazawa and Hideyuki Takahashi as it states, “ Roots display directional growth toward moisture in response to a water potential gradient. Root hydrotropism is thought to facilitate plant adaptation to continuously changing water availability. Regulatory mechanisms underlying the hydrotropic response appear to differ among different species. We recently performed molecular and genetic analyses of root hydrotropism in *Arabidopsis thaliana*,” (Miyazawa, Hidyuki, 9/15/2025, Para 1). This largely shows how hydrotropism plays a critical role in a plant's adaptation to the continuously changing water level. This in summary shows how plants will grow to the nearest water source in order to survive, but at what point do plants give up and stop trying to grow in order to find a moist environment.



Furthermore, one of Arizona’s most iconic plants, the **Palo Verde** tree, is affected by this problem of the decreasing water table. Merriam-Webster defines as, “Palo Verde as any of several small spiny trees or shrubs (genus *Parkinsonia* synonym *Cercidium*) of the legume family that have greenish branches and are found chiefly in dry regions of the southwestern U.S.

and Mexico," (Merriam-Webster, 9/26/2025, Para 1). This is displayed in one of the Palo Verde's many needs such as a sunny environment, garden soil preferably sand, loam and chalky substances, 6-7.5 soil **pH**, 8-11 hardness zone, and more specifically and watering depth of 3 feet. Merriam Webster defines as, "pH as as a measure of acidity and alkalinity of a solution that is a number on a scale on which a value of 7 represents neutrality and lower numbers indicate increasing acidity and higher numbers increasing alkalinity and on which each unit of change represents a tenfold change in acidity or alkalinity and that is the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter of the solution," (Merriam-Webster. 9/26/2025, Para 1). This watering depth is very important as a Palo Verde's roots averagely reaches only 3 feet which is a problem as with the decreasing water table it is getting harder and harder for natural desert plants to grow as at a specific point some plants roots can't reach that far down in order to get water this is seen in plants like the Palo Verde Tree. This can be seen in Avoiding Storm Damage - Desert Museum Palo Verde Trees by Noelle Jhonson as it states, "Water deeply to a depth of 3 feet. Deep roots are key to the stability of a tree and also decrease the chance of uplifting roots. Apply water toward the outer reaches of the branches where the roots are concentrated," (Jhonson, 9/22/2025, Para 6). This overall shows how Palo Verde trees, one of Arizona's most customary trees like the rest of the Arizonan plant species, are affected by this disaster. Though the Palo Verde Trees have its variations such as its more common blue and yellow variation it needs and problem is still mostly the same. This is why I have decided to use one of Arizona's most iconic desert survivors, the Palo Verde tree, as the plant to conduct this experiment as it would be to see a beautiful Arizonan plant die out.



In conclusion, based on my research, my hypothesis is that roots will grow towards the water table based on its relation with size. This means that naturally big plants such as trees will still have a difficulty in reaching the water table but not that much compared to small plants such as bushes, flowers, and grass. I think this because of three things first the history of our Arizonan water table which shows in a year by year scale the the water table is steadily decreasing, second hydrotropism which is the study of roots getting attracted to underground moisture, and finally third, the Palo Verde Tree one of Arizona's most iconic desert survivors whose having difficulty surviving this disaster as their roots usually only go down three feet. This is important to my project because my project is all about how the depth of the current water table affects the depth of root growth in the Palo Verde Tree. The main purpose of this experiment is to see at what level of the water table dropping do roots just stop trying to reach the water. This will show how much the ever decreasing water table is affecting desert plants in Arizona and how fast they will adapt to this ever dangerous situation.

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