# Runoff We Can Change: California Tule and California Milkweed as Natural Filters

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## Introduction

Watsonville is a community primarily based on agriculture and with agriculture comes big problems. Farms adding excess amounts of fertilizers like nitrates and phosphates can have harmful effects on the wetlands surrounding the agricultural fields and its aquatic organisms. Agricultural runoff is a problem that our community is facing. Agricultural runoff can cause eutrophication, which can lead to the disappearance of some wetlands and the aquatic organisms that live in the water because it increases algae blooms and decreases the oxygen level. For that matter we decided to base our W.A.T.C.H. project on testing California Tule and California Milkweed, to see which one acts as a better natural filter in reducing the amounts of nitrates and phosphates in the water. We believe that the California Tule will act as a better filter because its roots are always covered in water unlike the California Milkweed which can stand dry soil. We hope that by conducting this experiment we will be able to figure out which plant is the better natural filter and eventually plant more of that plant near a wetland so it could minimize the amount of nitrates and phosphates that enter the wetland.

## How to Compare Results

*In order to be able to compare the results of the two types of plants you need to follow a mathematical process:

California Tule
You add the amount of nitrates that the water of the four plants contained
You divide that answer by 5 because you added 5ml of nitrates
The answer that you get would be the average amount of nitrates that the water of four California Tule plants will contain after 1ml of nitrate per 100ml of water are added.
Do the same thing for the phosphates

California Milkweed
You add the amount of nitrates that the water of the four plants contained
You divide that answer by 3 because you added 3ml of nitrates
The answer that you get would be the average amount of nitrates that the water of four California Milkweed plants will contain after 1ml of nitrate per 100ml of water are added.
Do the same thing for the phosphates

## Materials

- 5 California Tule (alive)
- 5 California Milkweed (alive)
- Nitrate Testing kit(Chemetrics)
- Phosphate testing kit (Chemetrics)
- 10 cylinder pots
- 2 big pots
- 500ml cylinder
- Nitrates and phosphates (soluble)
- 10 round trays (about the same size or bigger than the size of the bottom of the pots)
- Medium size bark to fill 10 pots
- Sand
- Garden hose

## Methods

Preparations
Remove plants from the containers they were purchased in. Carefully remove all of the soil from the plant being careful not to destroy any roots. Rinse them off after removing all of the soil and rinse the pots as well.
Using the pots as measuring tools fill up one pot with sand and another one with bark.
In a bigger bucket pour both the sand and the bark and mix them thoroughly by pouring it back and forth between two big buckets.
Divide the mixture between two pots (the same ones you used for measuring) and repeat the process until you have filled up all 10 pots.
Make sure that the pots have holes in the bottom and place each one on top of a tray.
Number each California Tule 1-5 and each California Milkweed 1-5.
In a separate pot add bark until it is half filled up and then put the pot inside another bigger pot.

***Friday Protocol:***

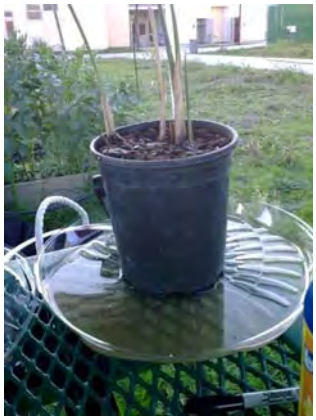
- First water all plants with 500ml of water(starting with California Tule#1-5 and then California Milkweed #1-5)
- Then water all the California Tule plants (#1-4) with 500ml of water and 5ml of phosphates and nitrates dissolved in the water
- Then water all the California Milkweed plants(#1-4) with 300ml of water and 3ml of phosphates and nitrates dissolved in the water
- Finally add 500ml of water to the pot with bark

*Do not add nitrates or phosphates to the 5th plant of California Milkweed and California Tule because you want to observe if the plants can survive without any nitrates or phosphates and potted in sand and bark.
*You want to add water to the bark to see if it actually absorbs any water.

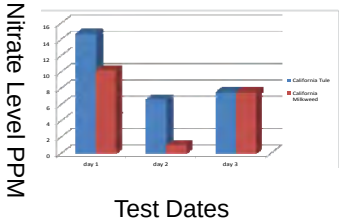
***Tuesday Protocol:***

- Dump any water that is left in the trays.
- Water every plant and collect the first 500mL of runoff
- Test for nitrates and phosphates
- Write down your results and compare them every test day.

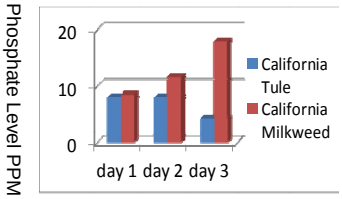
*Check if there is any water in the pot that has bark to see if it is moist and if all of the water was absorbed.
*Test it 3 different times



Average Nitrate Level
1ml per 100ml water




Average Phosphate Level
1ml per 100ml water




## Results

Our data showed that California Tule is better at filtering phosphates than California Milkweed. However, California Milkweed is better at filtering nitrates than California Tule. The graphs show that on the first test day California Tule contained 8 ppm of phosphates while California Milkweed contained 8.5 ppm of phosphates. It also showed that California Tule contained 14.7 ppm of nitrates while California Milkweed contained 10.2 ppm of nitrates.

Our second test day showed that California Tule contained 8 ppm of phosphates while California Milkweed contained 11.5 ppm of phosphates. It also showed that California Tule contained 6.6 ppm of nitrates while California Milkweed contained 1 ppm of nitrates.

Our third test day showed that California Tule contained 4.2 ppm of phosphates while California Milkweed contained 17.9 ppm of phosphates. It also showed that California Tule contained 7.5 ppm of nitrates while California Milkweed contained also 7.5 ppm of nitrates.

*Normally the average phosphate levels should be less than 1 ppm but below 0.1ppm is best to prevent algal blooms.

*Normally the average nitrate levels should be less than 3ppm but greater than 0.1ppm may cause algal blooms.

## Conclusion

By conducting this experiment we were able to figure out that California Tule is a better filter for filtering phosphates than California Milkweed. However California Milkweed is better at filtering nitrates than California Tule. In conclusion there was no real winner between the two plants. Our results showed that you need both plants in order to reduce the amount of nitrates and phosphates found in water; therefore our hypothesis was both wrong and correct which is a good thing. Our results suggest that there needs to be a diversity of plants in order to reduce agricultural runoff, and not just one. Planting filter strips around agricultural fields with a diversity of plants will reduce the amount of nutrients that enter the sloughs creating a healthier ecosystem.

Our future helping plans will start by educating the whole freshman class in P.V.H.S. about agricultural runoff. We will be giving them a detailed presentation referring to our project trajectory and doing a simulation of agricultural runoff. We will also be participating in Earth Day and informing the community about the negative effects that agricultural runoff causes.

## Literature Cited

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