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# Measuring Red Algae in the Santa Ana River

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# 1 Introduction

## 1.1 Problem Statement

iiiiiii HEAD This experiment explores whether there is a relationship between red algae (scientific name) presence in reaches of the Santa Ana River and the parameters of water temperature, overhead tree canopy cover, and sediment type. It will do so gathering data for which there is less information known - ===== The abundance of red algae, or as it is known by its scientific name Rhodophyta, has recently risen significantly in the Santa Ana River, at a questionably similar time that the Santa Ana Sucker, an endangered fish in the river, has been experiencing population declines. This experiment explores the change in red algae (Rhodophyta) presence in the Santa Ana River and the possible relationship it holds with Santa Ana Sucker's decline. Using measurements of river water temperature, overhead tree canopy cover, and sediment type we explore the connection these aspects of the river and their relationship with the red algae. llllllll e1c80c034104a85d34ee77fdbeb6d74b5935eb46

## 1.2 Background Research

This project is motivated by the decline of the threatened Santa Ana sucker, a small freshwater sucker sh endemic to southern California, where it is now present in only three rivers. While there are several threats to the Santa Ana sucker, including fragmentation of its river habitats and decreasing water levels and degradation to the riparian vegetation along the river (Thomson 2010), red algae presence has significantly increased at this same time that the Suckers are dying. For the Santa Ana River sucker habitat, a central threat is the invasive Red Algae that has been spreading with alacrity in areas where the sh are known to be, including the reach below the Rapid Infiltration and Extraction (RIX) Treatment plan (Los Huertos 2016). There are concerns that it may be one of the contributing factors to the suckers decline. This project therefore focuses on qualitatively identifying and analyzing the substrate on which the red algae grows, because one of the aspects of the suckers habitat is the presence of coarse substrate, that is, gravel and cobble, as opposed to silt and sand (Thomson et al. 2010, 321). The sucker has adapted to feeding on the diatoms that tend to grow on the former. There is also evidence that some of the diatoms on which the sucker feeds may be able to grow on the algae (are epiphytic) (Los Huertos 2016). This may lead to the sucker being in contact with the algae when feeding. If the sucker is ingesting the algae, this may constitute a factor to the Suckers decline. Of course, ingesting the algae is not a necessity to the sh being negatively impacted; the algae may also disrupt the shs well-being in unknown ways. Some researchers suggest that it actually crowds out the diatoms on which, along with algae and detritus, the sucker feeds (Thomson 2010, 322). The presence of the algae in the same area and on the same type of substrate as the sh could indicate competition for resources between the algae and the sh.

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### 1.3 Materials and Equipment

\*GPS Spherical Canopy Densimeter \*30cm x 30cm PCV Quadrat \*Analog Thermometer \*10 m string/rope \*Recording material \*Computer \*RStudio Server +Microsoft Excel =====

### 1.4 Materials and Equipment

Water-quality Testing instruments GPS (included in testing instruments) Fo-  
liage Testing instrument 30cm x 30cm Quadrat Water Temperature Measurer  
Water sediment sample bottle 10 m string/rope [iiiiii e1c80c034104a85d34ee77fdbeb6d74b5935eb46](#)

### 1.5 Methods

### 1.6 Site Description

FIX SITE NAMES We evaluated 3 reaches of the Santa Ana River, with 9 observations per reach. Site A (plunge pool): 34°25' N, 117°21'17" W Site B (below confluence): 34°22'1" N, 117°21'20" W Site C (above confluence): 34°22'9" N, 117°21'15" W. Each observation contains the following variables: algae percent cover, canopy cover, water temperature, bed composition. near Colton, California (Figure 1).

### 1.7 Field Methods

Site selection: 3 measurements 1-10m apart for 4 different reaches. Use random number generator to select distance. 12 measurements total. Reach 1 = original site visited already. Must select Reaches 2 3 in between. Reach 4 = sh-rich pool half hour downstream 30 minutes to walk down to reach D where we will start, then proceed back upstream. ATEACHSITE(25minuteseach): Algae: usequadrat30cmx30cm. Take three measurements on right bank, middle, left bank. For each measurement, estimate Pebble count. (What was the pebble structure and was the algae on the pebbles) Pebble size: qualitatively note grain size of streambed: cobbles, pebbles, coarse sand, ne sand, or silt. Canopy cover: directly above each algae measurement, use canopy cover instrument to determine canopy cover. Temperature: 3 measurements per site, left middle and right. Time of each measurement Notekeeper who records as team members call out measurements TOTAL TIME NEEDED: 2 hours 40 mins

### 1.8 Laboratory Methods

### 1.9 Statistical Methods

iiiiii HEAD After conducting our fieldwork, we imported our data in rstudio and generated summary statistics using the following code:



Figure 1: Google Earth –THIS IS HOW YOU DO A CAPTION IN CASE WE NEED IT

```
updateddata= "/home/CAMPUS/fc102013/Santa-Ana-Sucker-Recovery/Data/Data_TUES_1/updatedtemps
importupdated=read.csv(updateddata)
```

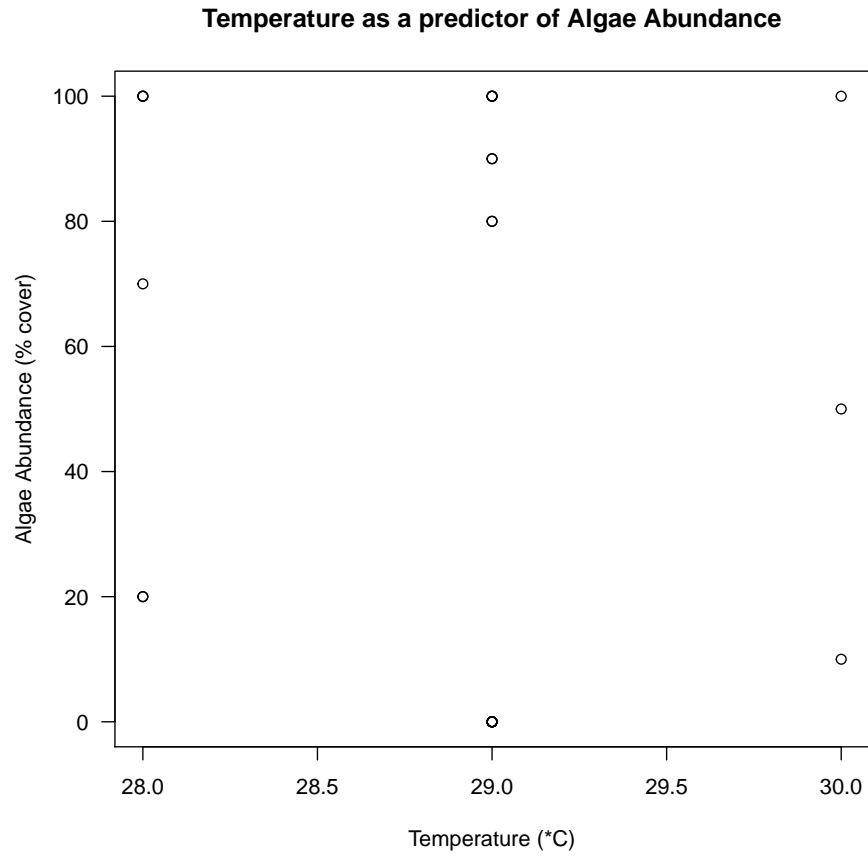
===== After conducting our eldwork, we will enter our data in rstudio. We will produce linear regressions of temperature vs algae abundance. We will produce linear regressions of canopy cover vs algae abundance. We will produce linear regressions of canopy cover vs temperature. We will create ANOVA or t-tests of bed composition vs. algae abundance. We will then analyze our data and write a project report 4-5 pages long with pictures and gures. We should hopefully be able to draw conclusions about canopy cover, temperature, and stream bed compositions eect on algae abundance. In qualitative terms, we will synthesize our results with the sh videography team and state whether our observed relationship between stream conditions and algae abundance matches the frequency of their sh observations. The following code was used to generate summary statistics. INSERT CODE FOR SUMMARY STATISTICS *lllllll* f31b8abefbb905befede6108d156a650b766b1ff

Note that \*Temp<sub>x</sub>\*entrieswereborrowedwithpermissionfromSophieandNicole'sdataset.Wealsocreateda linearregressionoftemperaturerangevsalgaebundancelinearregressionofcanopycovervsalgaebundanceAN

## 2 Results

The temperature data we collected with an analogue thermometer was too coarse to really be useful (Figure 2).

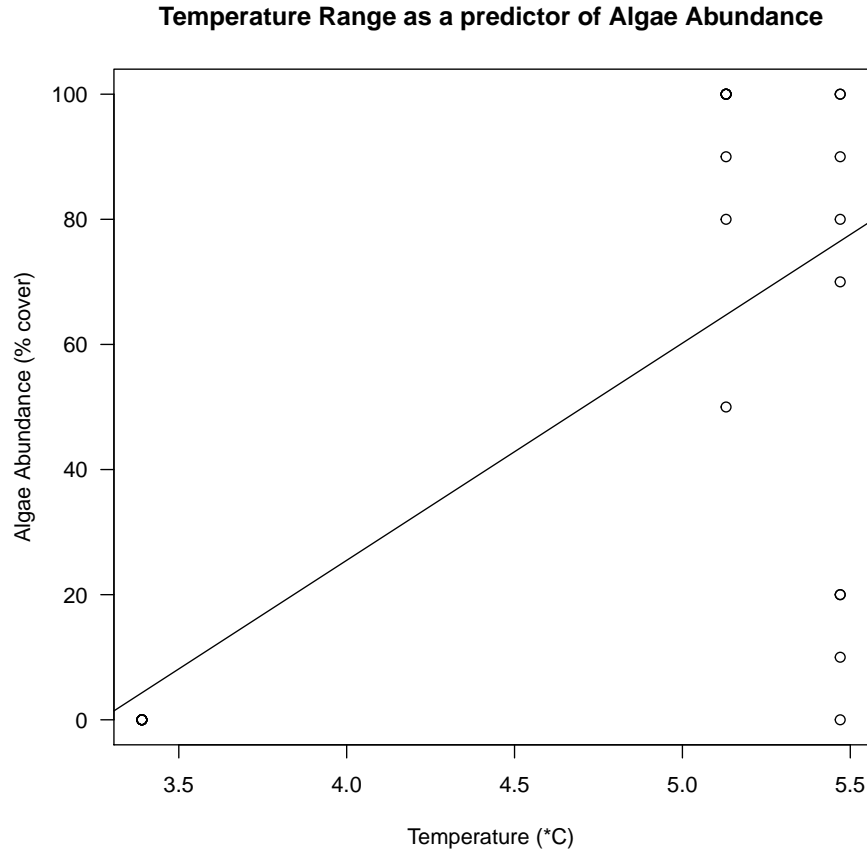
```
plot(importupdated$Temperature,importupdated$Algae, ylab="Algae Abundance (% cover)",xlab="T
```



So instead used WED1 team's temperature data. The following is a plot of algae abundance as a function of temperature range (\*C) at each site.

```
plot(importupdated$Temp_range,importupdated$Algae, ylab="Algae Abundance (% cover)",xlab="Temperature (*C)",
abline(lm(Algae~Temp_range,importupdated))
```





While using our temperature data yielded p-value: 0.446, using the other teams's temperature range data yielded p-value: 3.49e-05. There is a strong nonrandom relationship between the range of temperatures a site experiences and the abundance of algae. However, with an Adjusted R-squared of only 0.4826, there are clearly other important variables at work.

The temperature data suggests... (Figure 2).

### 3 Discussion

We

### 4 Conclusion and Recommendations

Time Series of Temperature Data

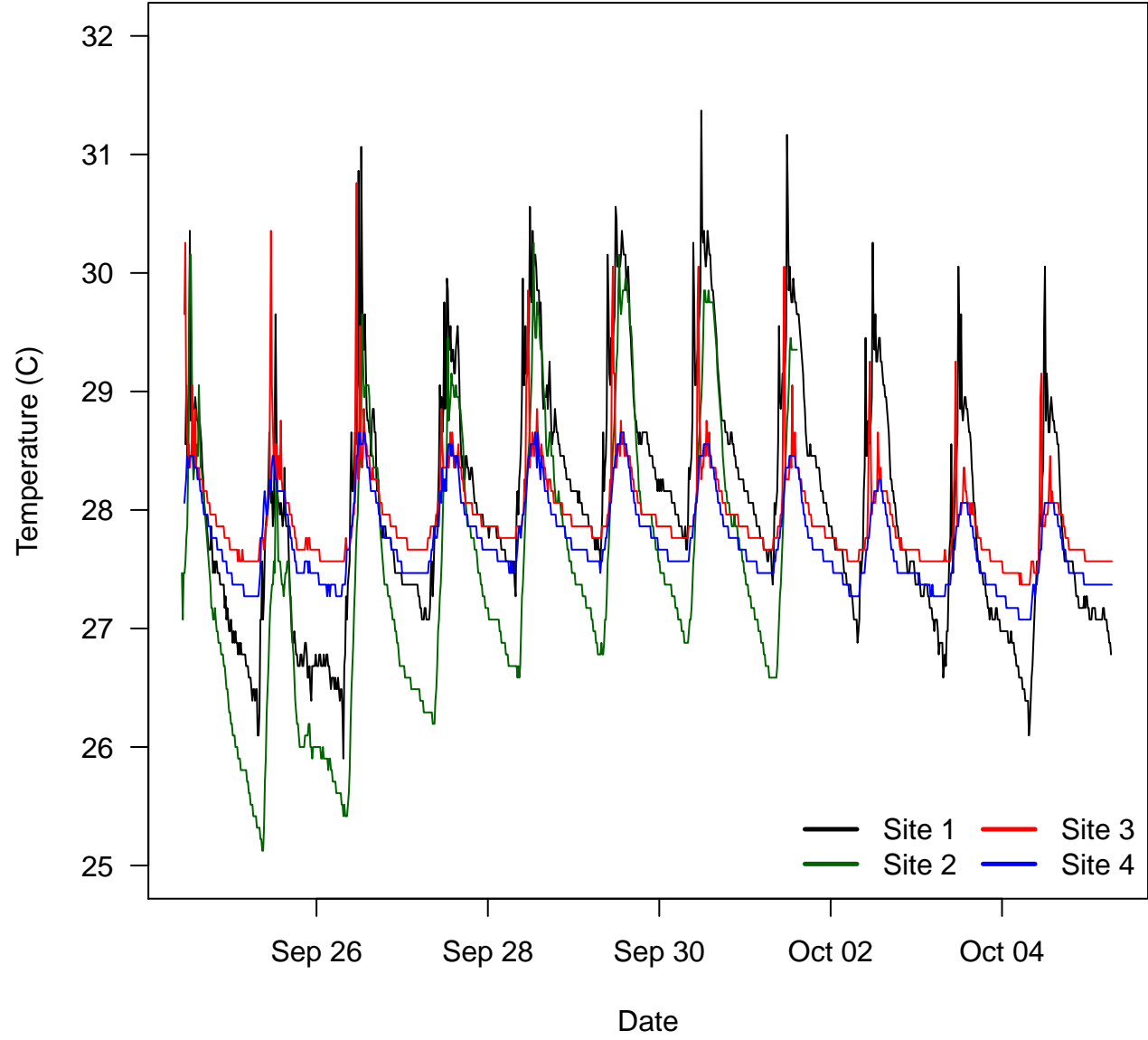


Figure 2: Temperature time...