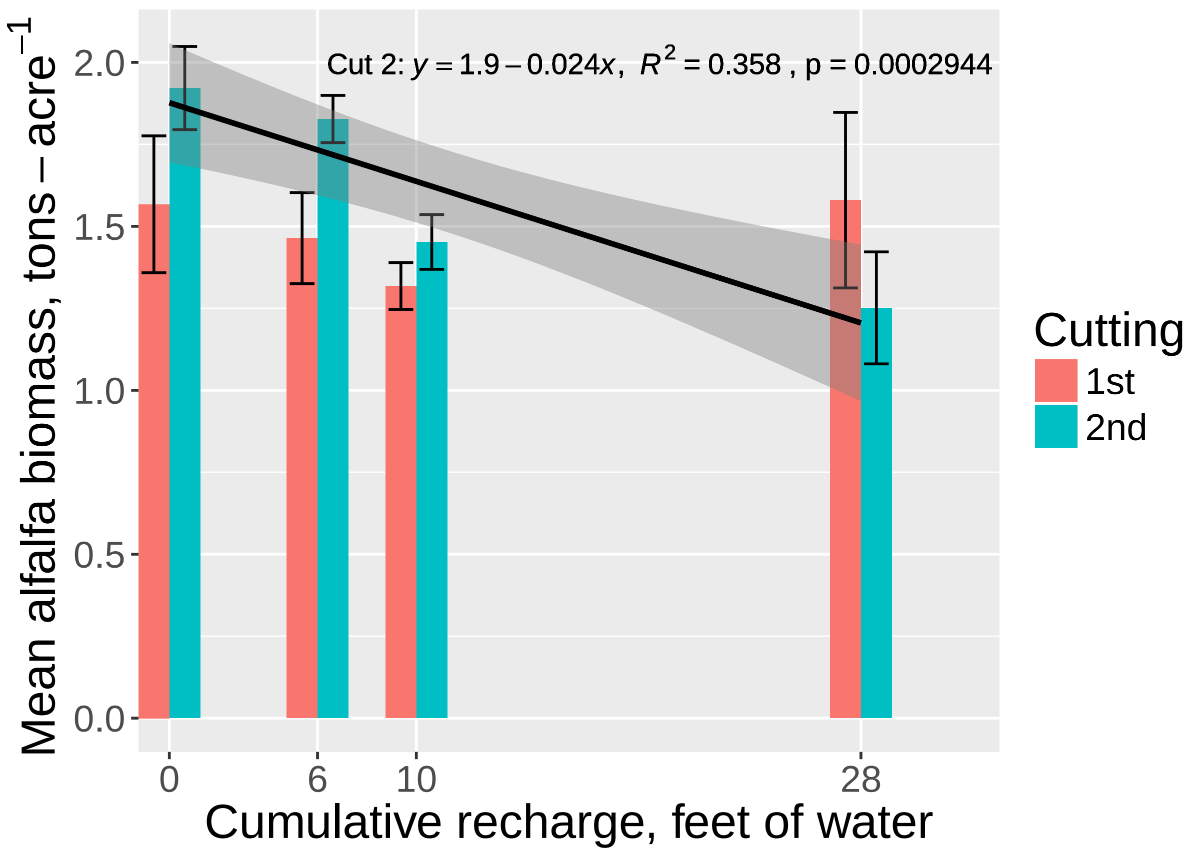
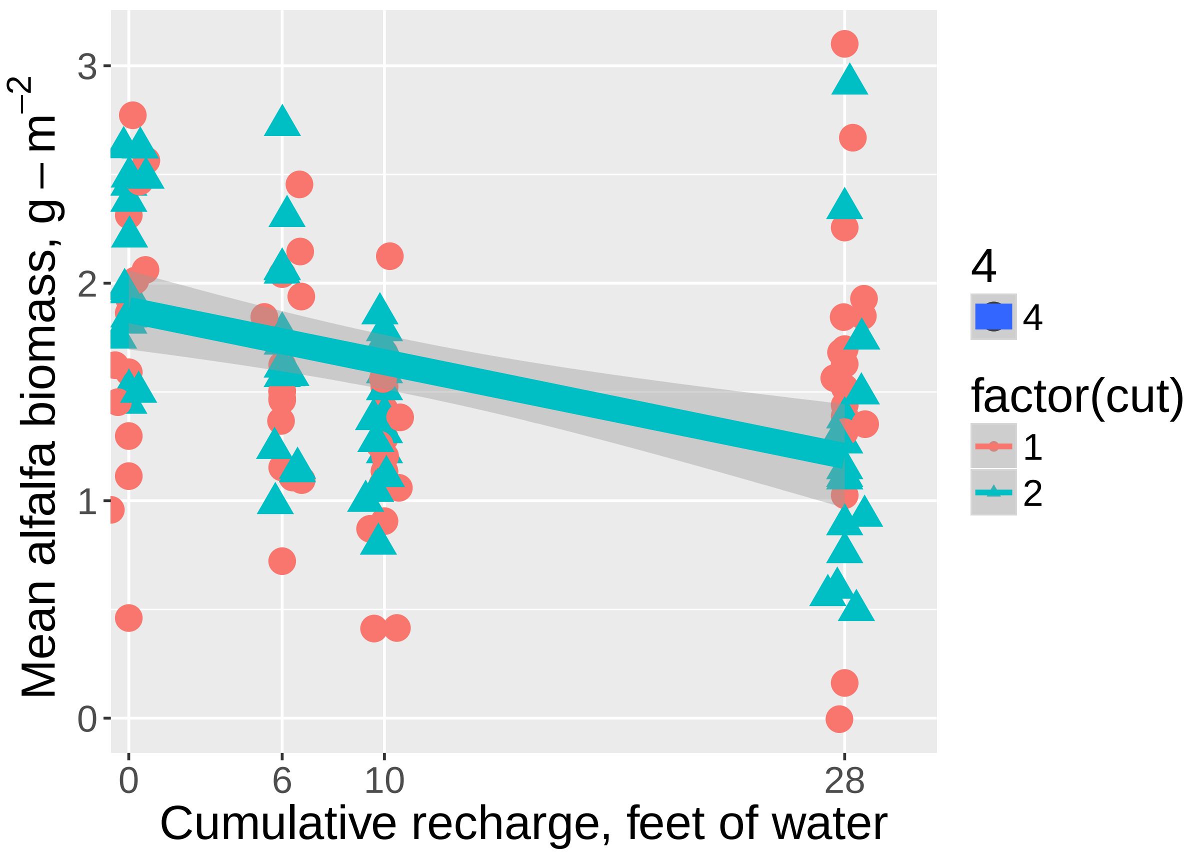
February 2016 - Alfalfa Flooding Tolerance Project Summary

Andrew Brown

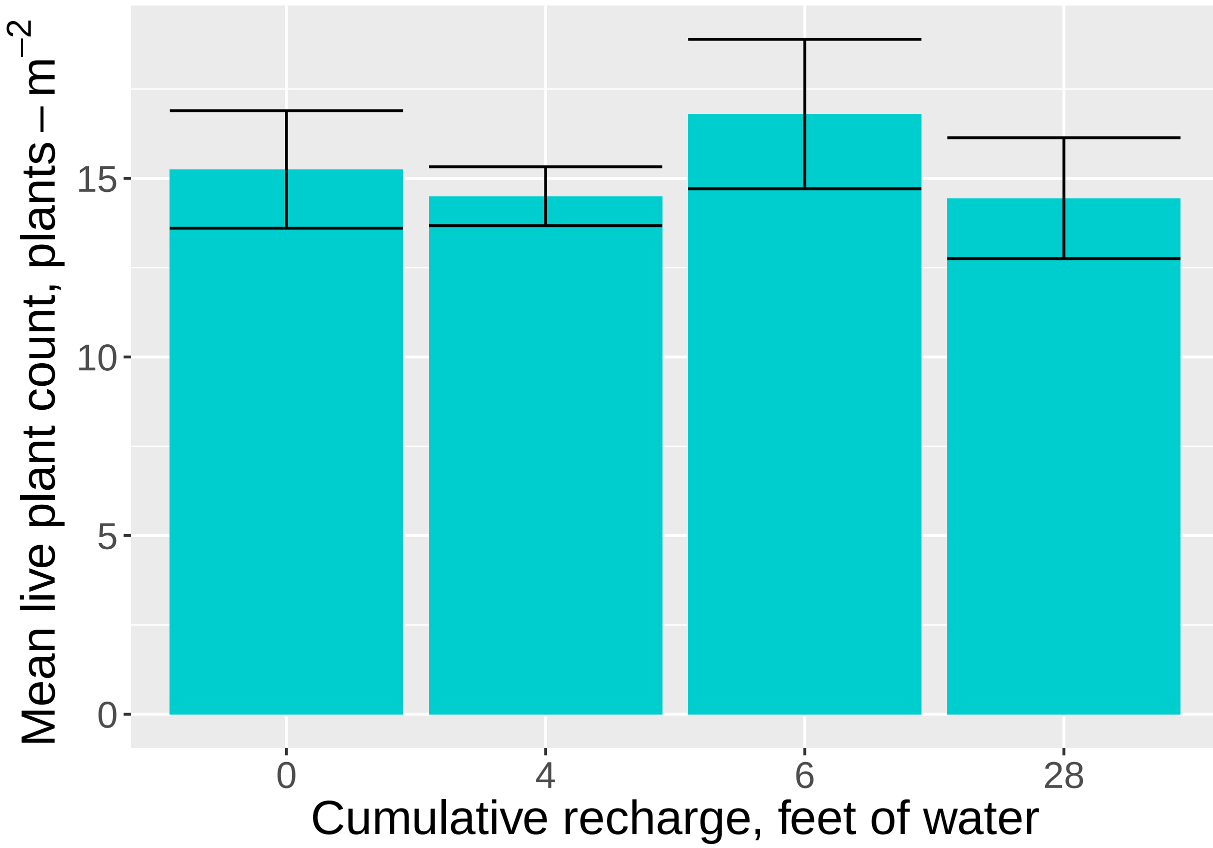
```
## Warning in svbio$bio[c1] + svbio$bio[c2]: longer object length is not a
## multiple of shorter object length

##               Df Sum Sq Mean Sq F value Pr(>F)
## ntreat         1  0.769  0.7688   3.691 0.0592 .
## cut            1  0.296  0.2963   1.423 0.2374
## ntreat:cut     1  1.284  1.2841   6.165 0.0157 *
## Residuals     63 13.122  0.2083
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```





Scott Valley alfalfa biomass: first and second cutting. For the first cutting there were no differences in biomass produced across levels of flooding intensity. For the second cutting the control (C) and low (L) treatments had the highest biomass, while the high (M) and continued (H) treatments had lower biomass. Biomass was collected from 0.5 m^2 quadrats, dried at 60 degrees C and weighed. Error bars show standard error of the mean of n=8 replicate quadrats per treatment for a total of 32 independent observations per cutting.



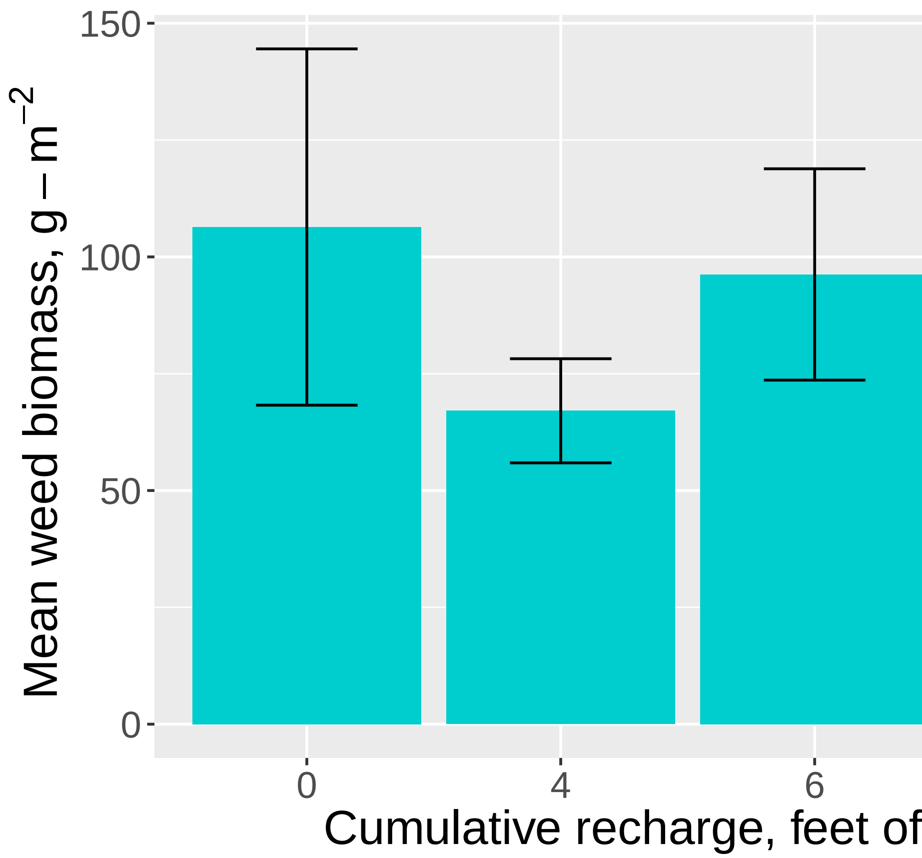

```
##
## Call:
## lm(formula = sv_weed$AlfBag ~ sv_weed$WeedBag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -144.569  -34.966    4.113   29.659  214.860
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)     159.2848    15.7200  10.133 1.16e-11 ***
## sv_weed$WeedBag  -0.4716     0.2659  -1.773   0.0854 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 62.84 on 33 degrees of freedom
## Multiple R-squared:  0.08702,    Adjusted R-squared:  0.05935
## F-statistic: 3.145 on 1 and 33 DF,  p-value: 0.08538
```

```
##
## Call:
## lm(formula = sv_weed$ppc ~ sv_weed$WeedBag)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -3.0151 -1.6656 -0.3148  0.7538  5.3344
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)      8.965864   0.543132  16.508  < 2e-16 ***
## sv_weed$WeedBag -0.030030   0.009188  -3.268  0.00253 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.171 on 33 degrees of freedom
## Multiple R-squared:  0.2446, Adjusted R-squared:  0.2217
## F-statistic: 10.68 on 1 and 33 DF,  p-value: 0.00253
```

```
##
## Call:
## lm(formula = sv_weed$X.Cover ~ sv_weed$WeedBag)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -20.524 -13.517  -6.208   4.162  49.641
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)     37.29471    5.00346   7.454 1.44e-08 ***
## sv_weed$WeedBag -0.05593    0.08464  -0.661    0.513
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 20 on 33 degrees of freedom
## Multiple R-squared:  0.01306,    Adjusted R-squared:  -0.01685
## F-statistic: 0.4367 on 1 and 33 DF,  p-value: 0.5133
```

Scott Valley plant (crown) count, first cutting. Plant counts were not significantly different across the different levels of flooding. Plant counts are inversely proportional to weed biomass. Increased plant count is correlated



with higher biomass, but appears to plateau.

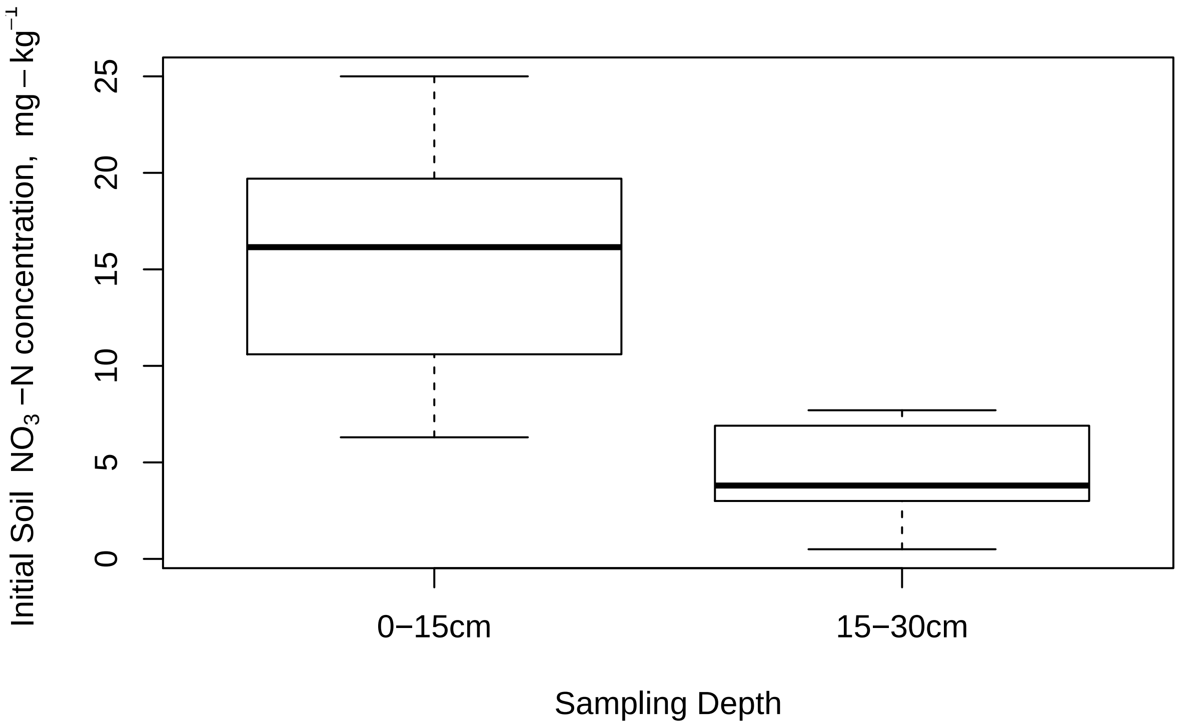
Scott Valley weed biomass, first cutting. Weed biomass in the first cutting was appreciable so we measured it separately. There were no significant differences in the mean weed biomass due to treatment effects. However, it was shown that weed biomass was inversely proportional to alfalfa plant counts per area. Clearly, interruption of herbicide spray events prior to the first cutting will allow weeds to take hold, but in this case the amount of weed biomass produced was not different across levels of flooding intensity.

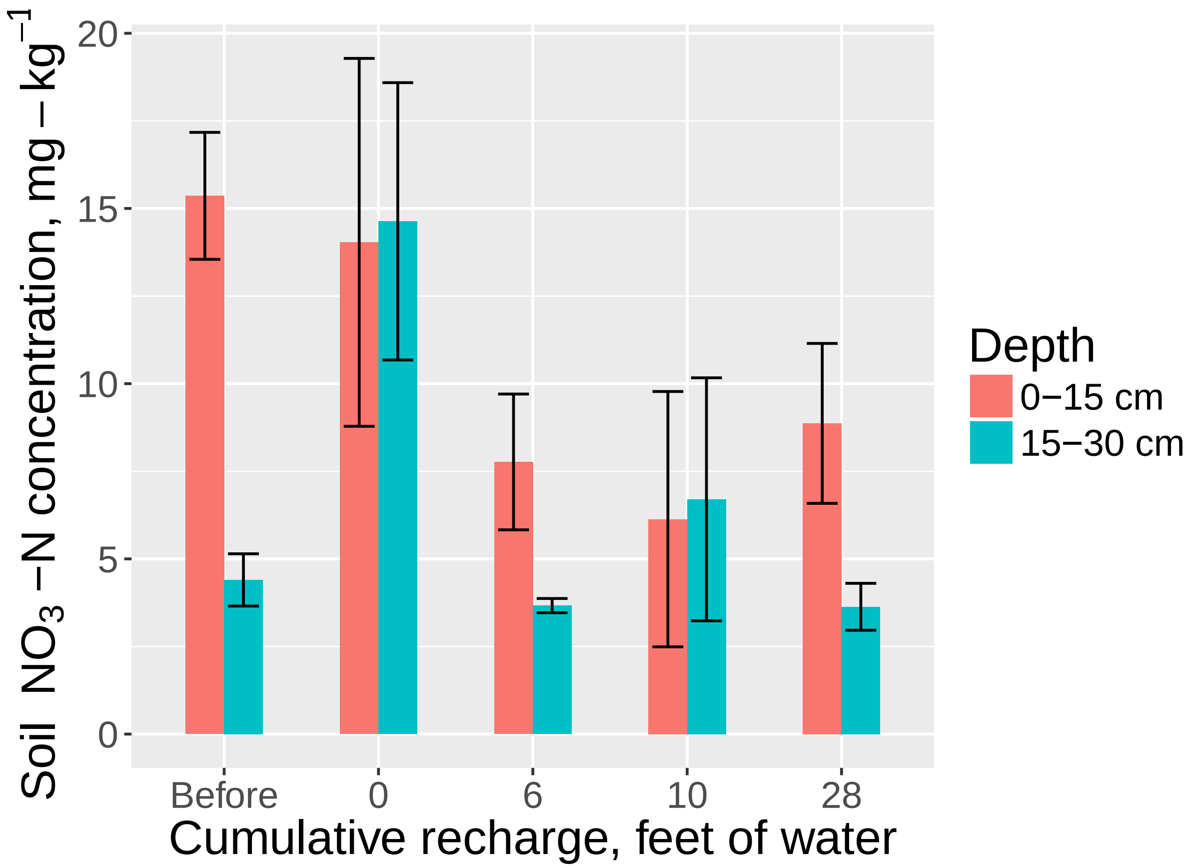
```
## [1] 15.36
```

```
## [1] 4.4
```

```
##
##  Shapiro-Wilk normality test
##
## data:  sepN[, 1]
## W = 0.95968, p-value = 0.7822
```

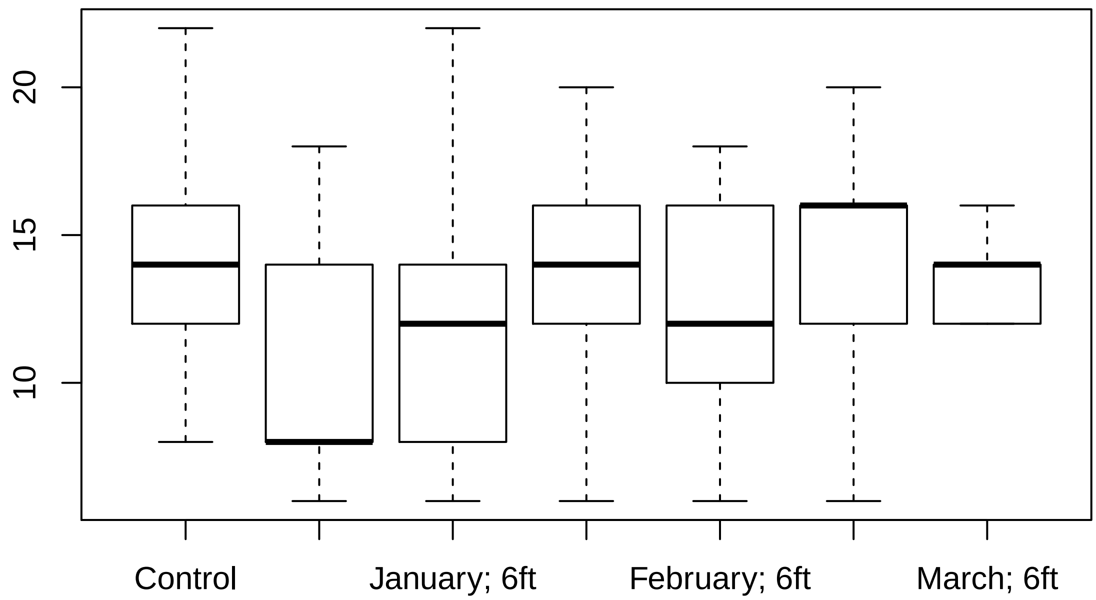
```
##
##  Shapiro-Wilk normality test
##
## data:  sepN[, 2]
## W = 0.94555, p-value = 0.6163
```


Initial Soil NO_3-N concentration, $mg-kg^{-1}$
0
5
10
15
20
25
0−15cm
15−30cm
Sampling Depth



Soil near-surface NO3-N concentrations in July after winter flooding events. NO3-N concentrations were not significantly different in the surface 15cm. However, in the 15-30cm interval, the Control had a significantly higher mean concentration. The control had one observation point with 0-15, 15-30 and 30-45 cm intervals all above 20 mg/kg, which does influence the values upwards for the mean concentrations for those depth intervals. Error bars reflect the standard error of the mean of n=3 replicates.

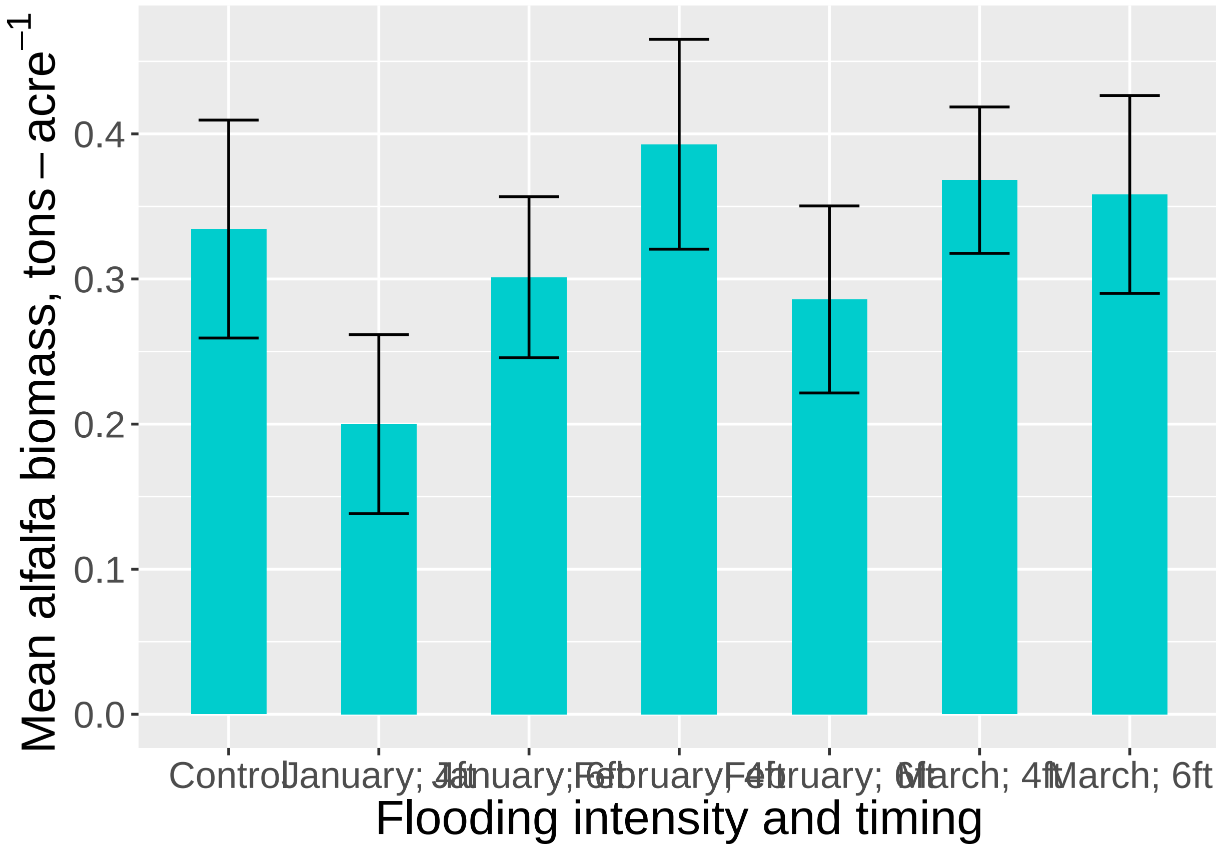
C Tract

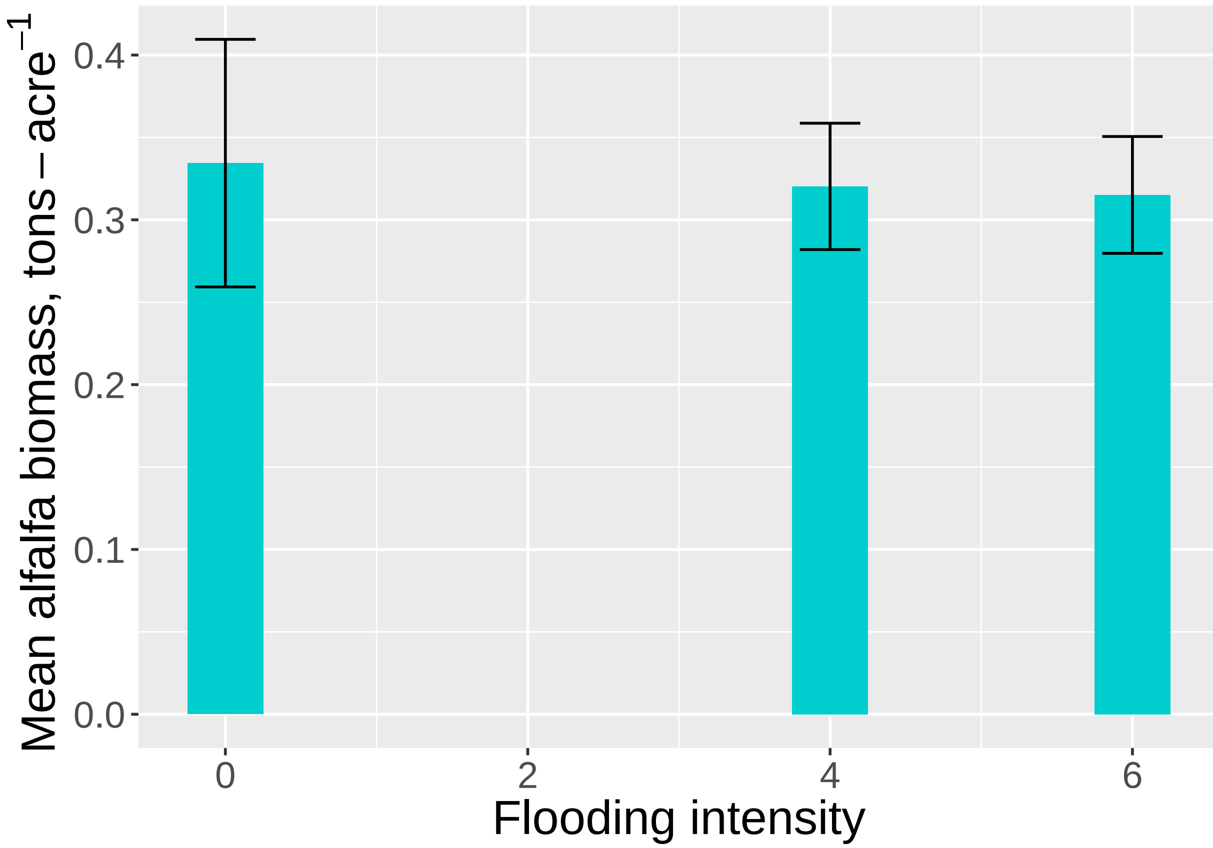


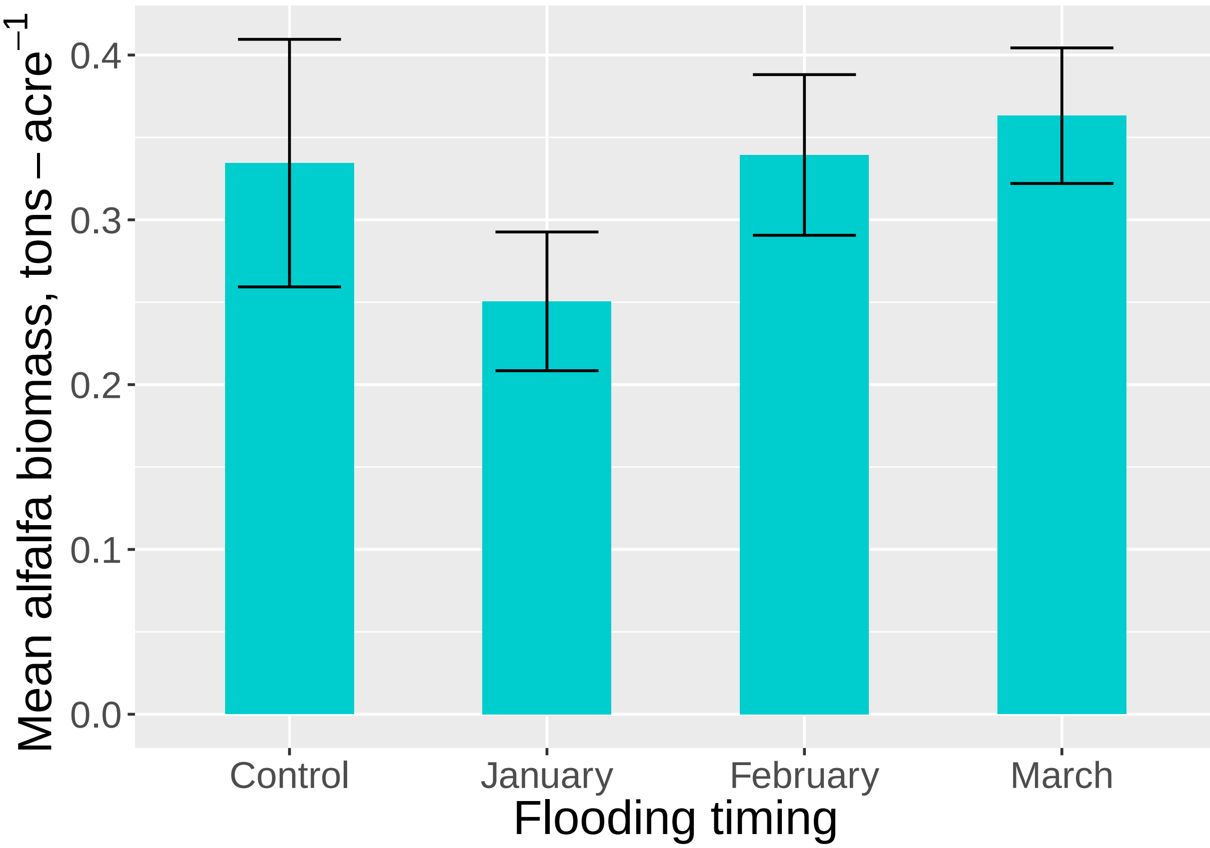

```
##                   Df Sum Sq Mean Sq F value   Pr(>F)
## ct_bio$treat       6   96.0    16.0   0.934    0.478
## ct_bio$initialP    1  427.6   427.6  24.958 6.29e-06 ***
## Residuals         55  942.2    17.1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##                   Df Sum Sq Mean Sq F value Pr(>F)
## ct_bio$treat       6   1522  253.62   1.440  0.216
## ct_bio$initialP    1     17   17.16   0.097  0.756
## Residuals         55   9689  176.16
```

```
##                   Df Sum Sq Mean Sq F value Pr(>F)
## ct_bio$treat       6 0.2272 0.03786   1.000  0.435
## ct_bio$initialP    1 0.0132 0.01317   0.348  0.558
## Residuals         55 2.0822 0.03786
```


Mean alfalfa biomass, tons – acre⁻¹
0.0
0.1
0.2
0.3
0.4
Control
January; 4ft
January; 6ft
February; 4ft
February; 6ft
March; 4ft
March; 6ft
Flooding intensity and timing


Mean alfalfa biomass, tons – acre^{-1}
0.0
0.1
0.2
0.3
0.4
0
2
4
6
Flooding intensity

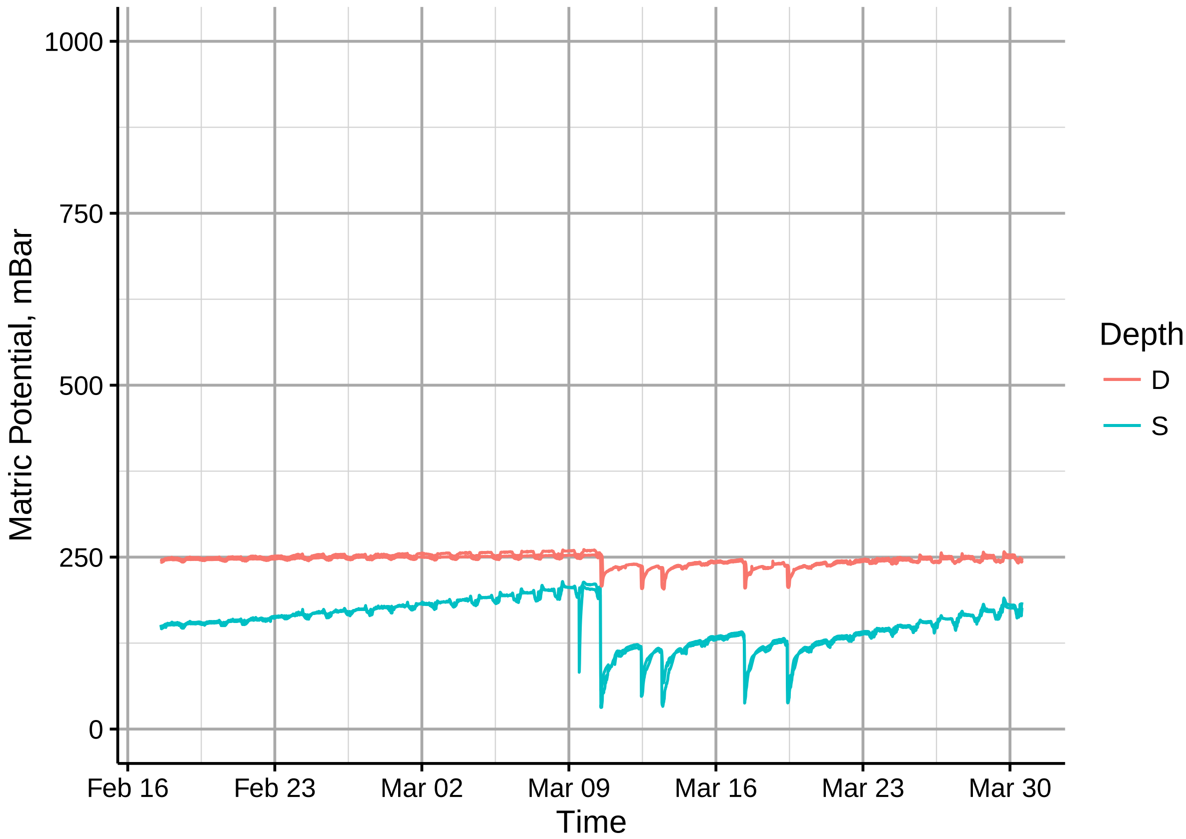


C TRACT alfalfa biomass from plots flooded at three different time intervals (J: January; F: February; M: March) during the winter. Plots recieved a 'low' 4 ft (L) or 'high' 6 ft (H) amount of water during that interval. Control (non-flooded) plots were included. The impacts of the flooding (timing or intensity) were not discernible based on the natural variation in the old stand at the site. The yield was low for all plots overall, but this was independent of treatment effects. Weak effect of timing when control (no flood) treatment is omitted ($p<0.1$) suggesting later application times could counteract yield losses in first cutting (especially in a dry year).

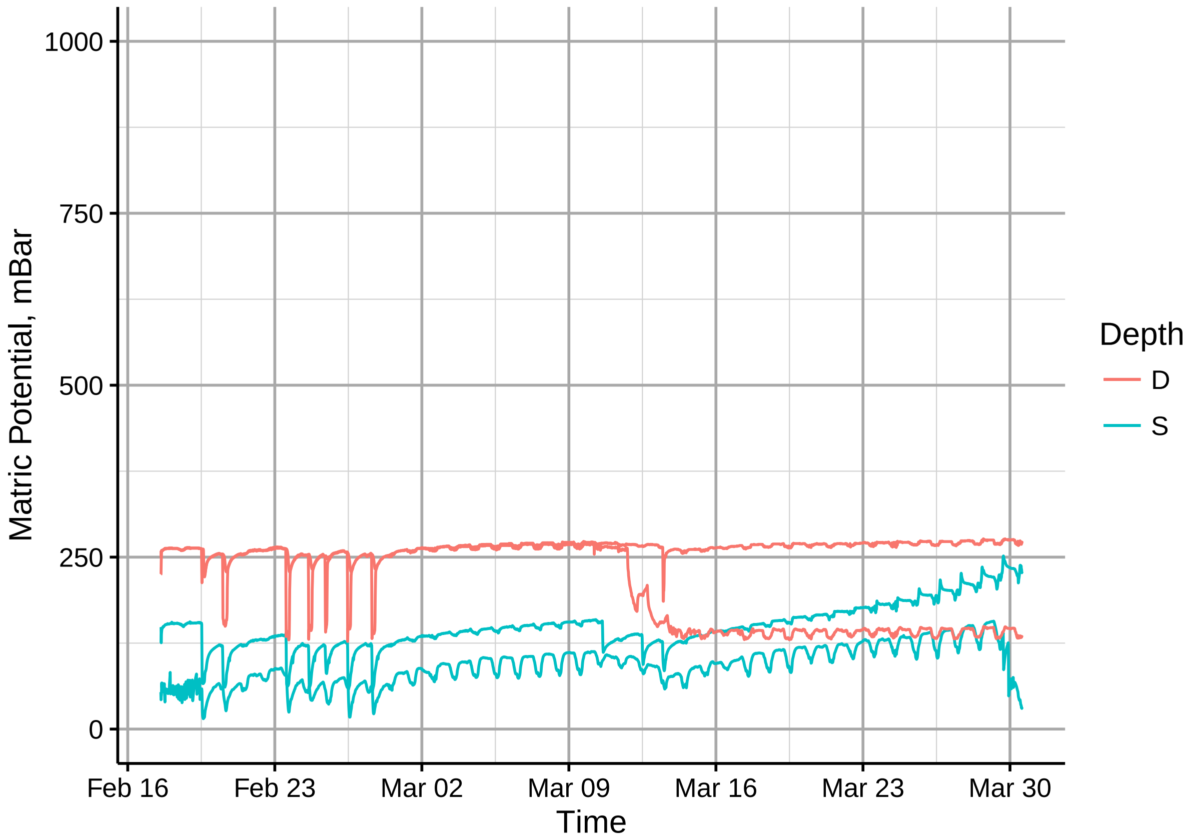
```
## [1] 4
```

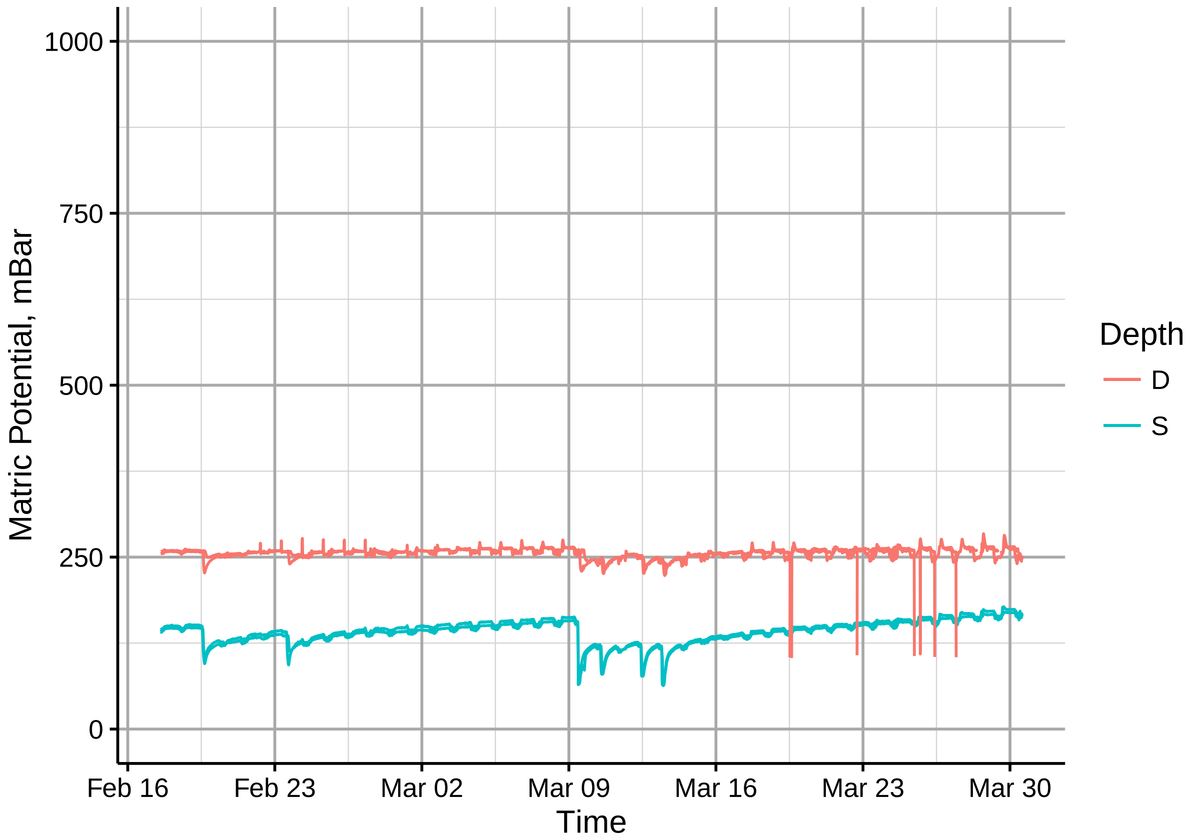
```
## [1] "Soil water storage loss over duration of experiment by treatment (cm H2O)"
```

```
##          C     MH       FH        ML       FL
## 1 9.345762 1.2454 2.992925 0.9289863 1.236754
```

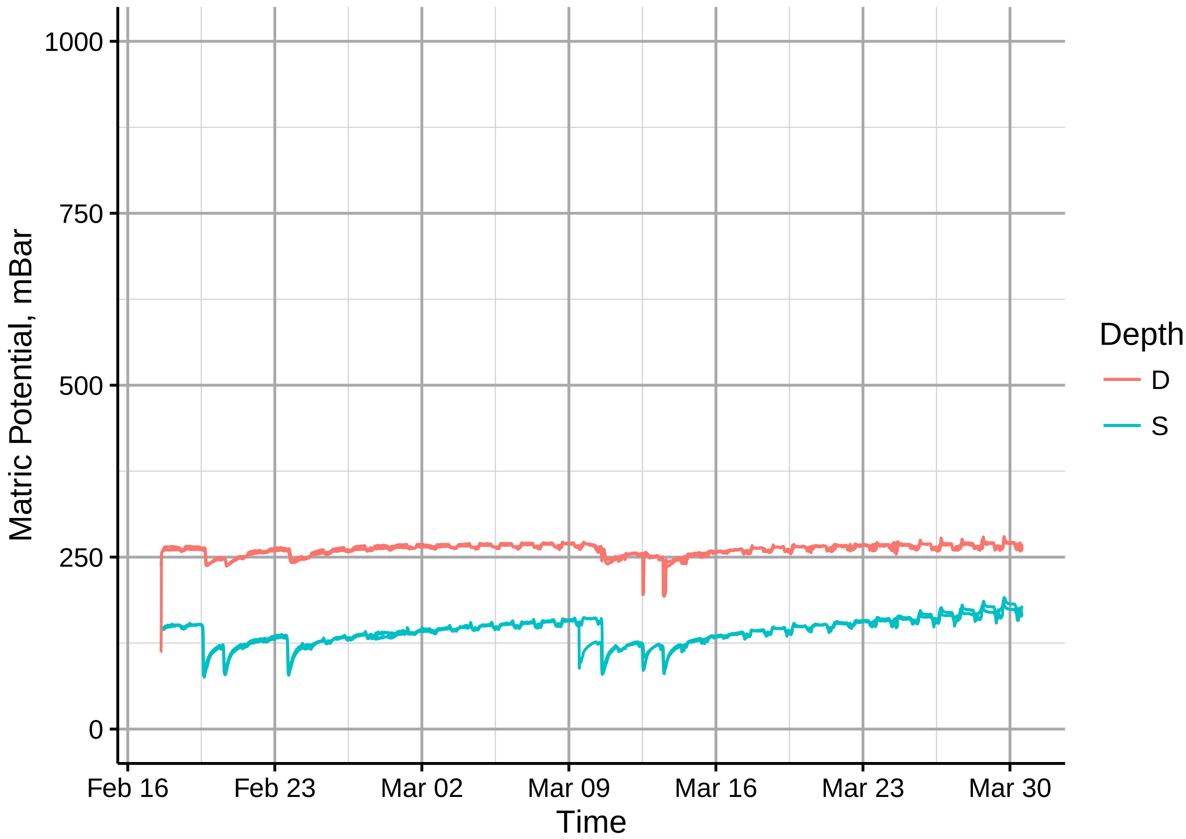


Matric Potential, mBar
1000
750
500
250
0
Feb 16
Feb 23
Mar 02
Mar 09
Mar 16
Mar 23
Mar 30
Time
Depth
D
S

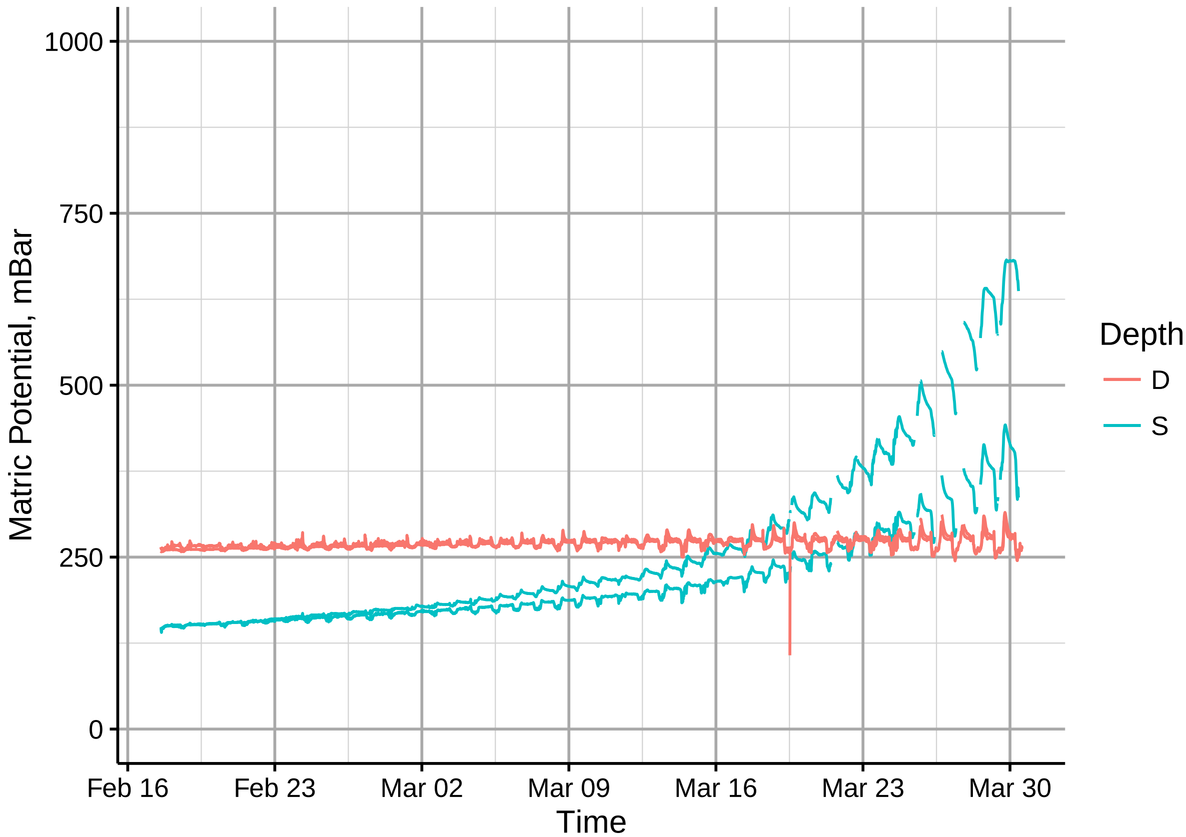

1000
750
500
250
0
Matric Potential, mBar
Feb 16
Feb 23
Mar 02
Mar 09
Mar 16
Mar 23
Mar 30
Time
Depth
D
S



Matric Potential, mBar
1000
750
500
250
0
Feb 16
Feb 23
Mar 02
Mar 09
Mar 16
Mar 23
Mar 30
Time
Depth
D
S



1000
750
500
250
0
Matric Potential, mBar
Feb 16
Feb 23
Mar 02
Mar 09
Mar 16
Mar 23
Mar 30
Time
Depth
D
S



1000
750
500
250
0
Matric Potential, mBar
Feb 16
Feb 23
Mar 02
Mar 09
Mar 16
Mar 23
Mar 30
Time
Depth
D
S