The role of mulches in bioretention performance, from a maintenance and water quality perspective

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SAM Stormwater Action Monitoring

WASHINGTON STATE UNIVERSITY EXTENSION

WASHINGTON STORMWATER CENTER

Questions

1. What are the water quality treatment benefits associated with three types of mulch?

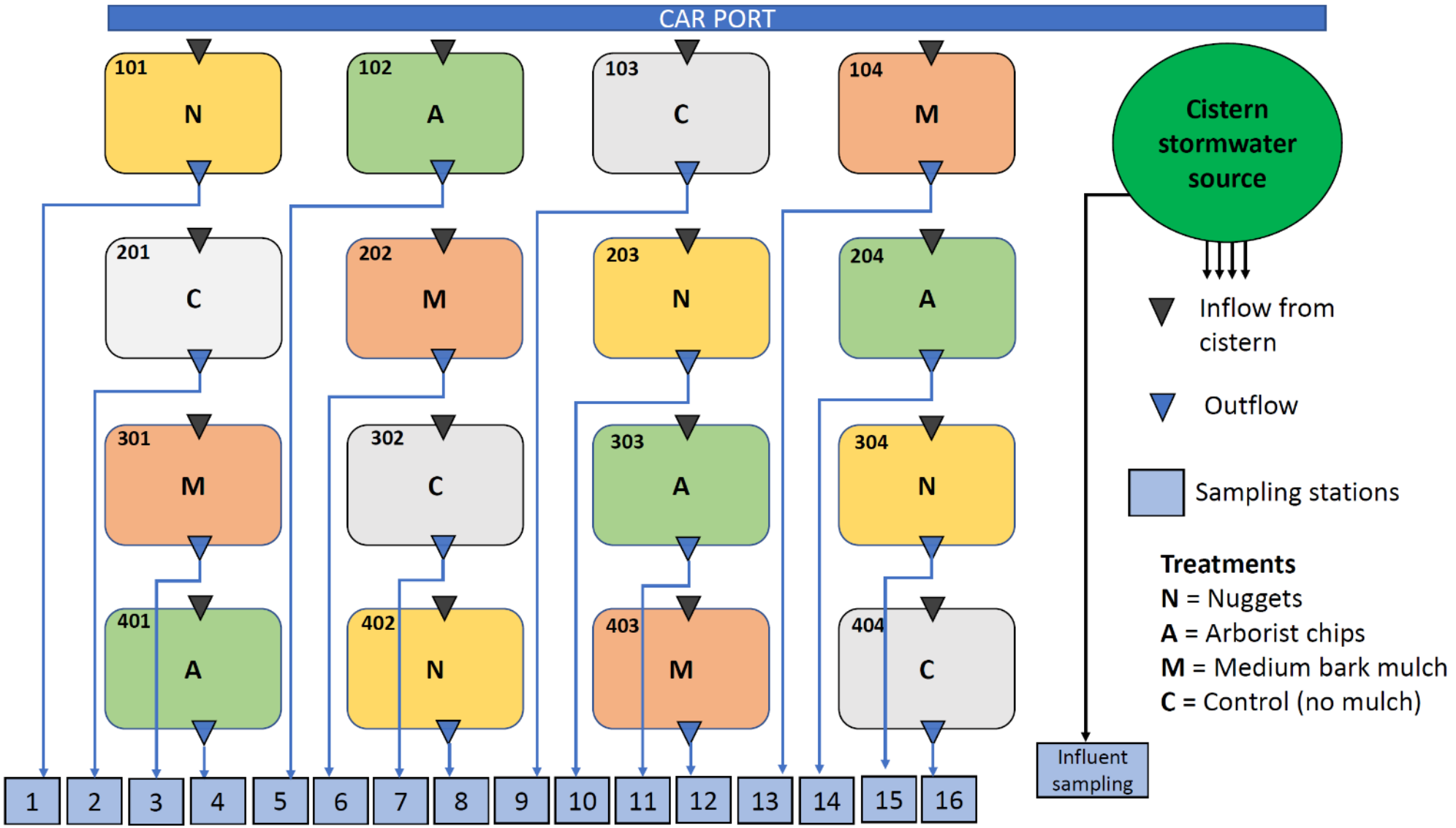
2. Do certain mulches improve flow control?

3. Do certain types of mulch minimize maintenance effort (hours weeding etc.)?

1. Nugget bark mulch
2. Medium (fir) bark mulch
3. Arborist chips

Approach

- 16 bioretention cells – ALL 60:40 mix and planted
- 3 mulch types: replicated 4 times, 4 cells no-mulch control
- ONE plant palette across 16 cells
- Dosed artificial storms - measured inflow, outflow, & WQ
- Performance by pollutant removal rates (Dis. Cu, Dis. Zn, Total P, TSS, TPH, DOC)
- Measured maintenance effort (mulched vs control)
- Measured flow alteration (mulched vs control)


CAR PORT
101
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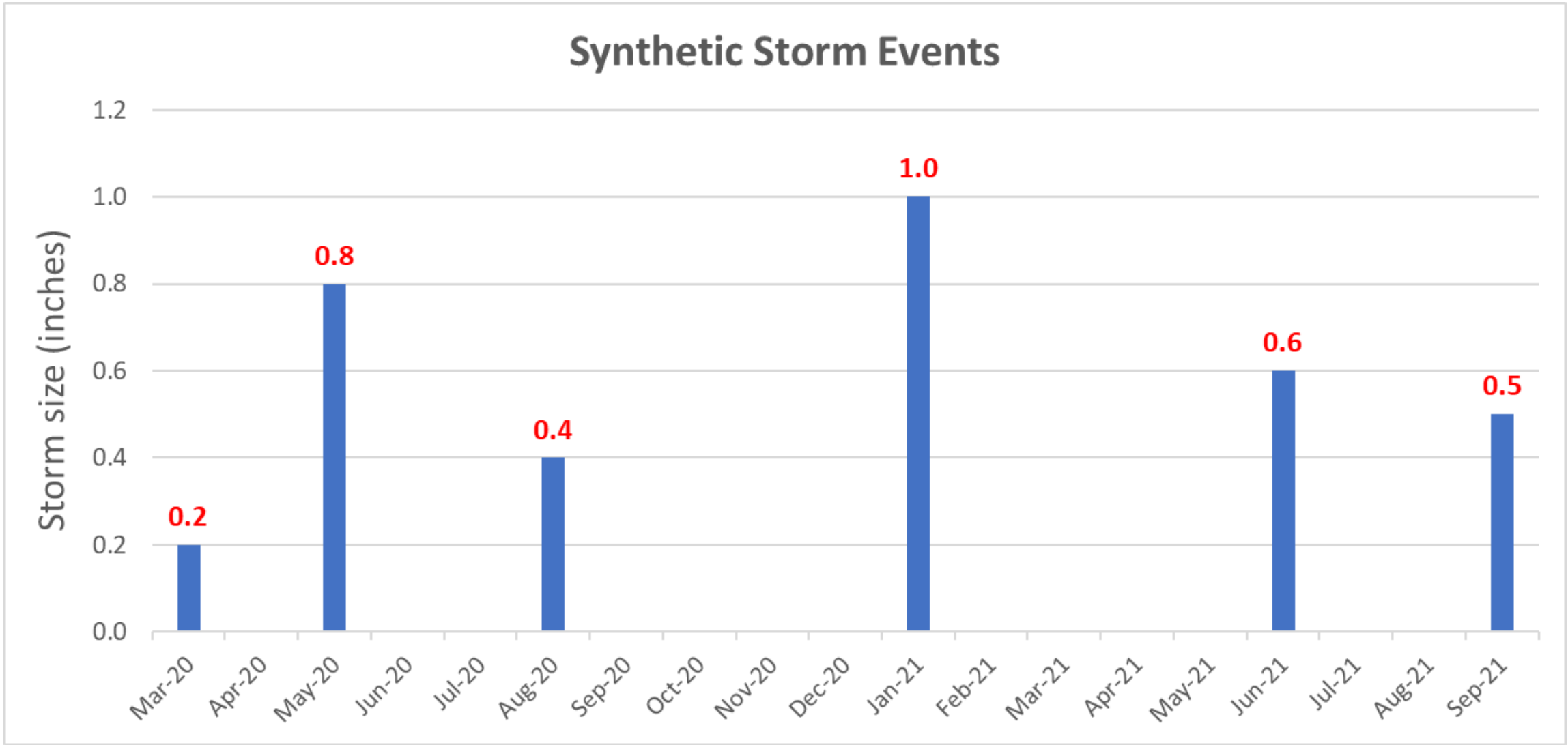
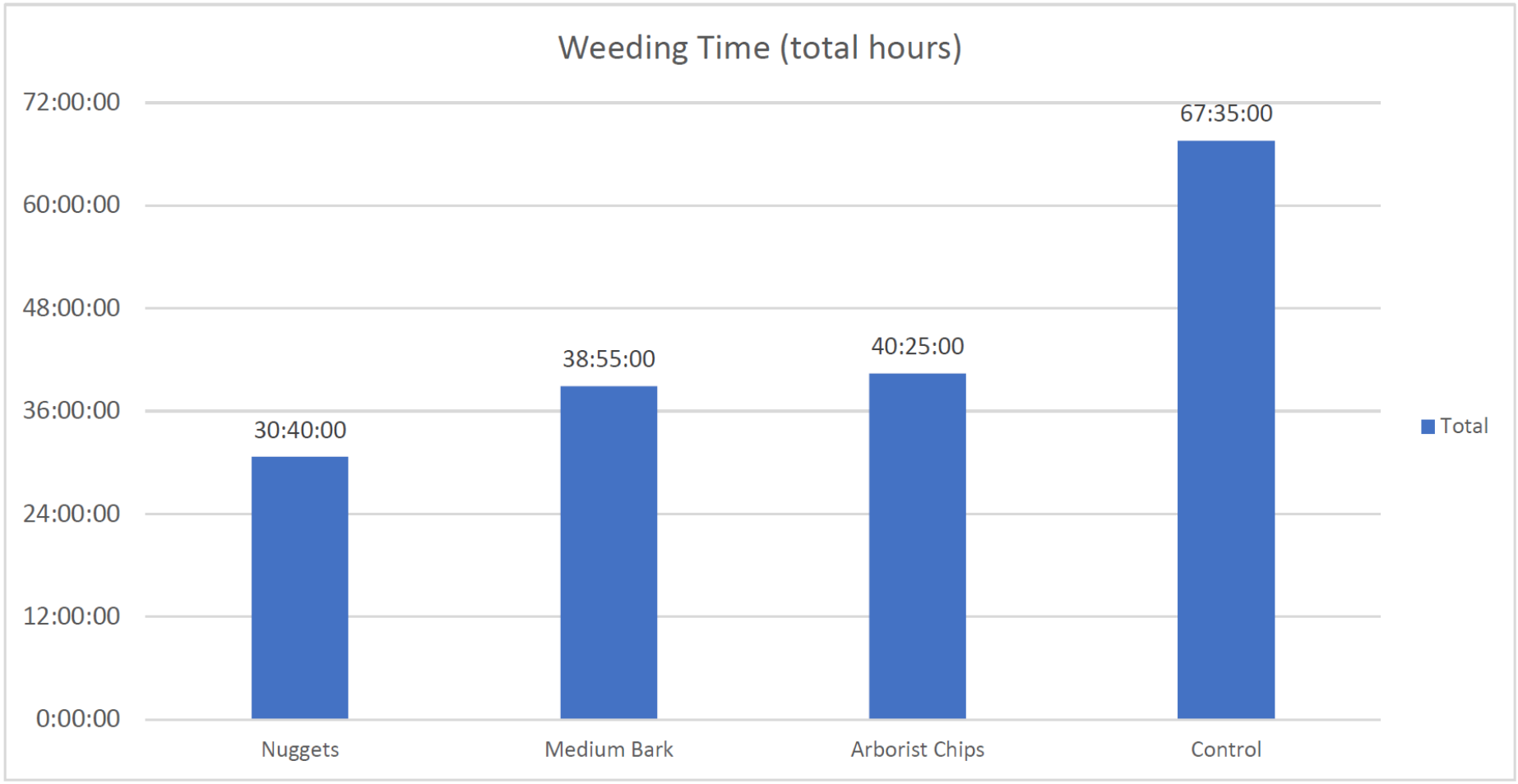
Cistern stormwater source
Inflow from cistern
Outflow
Sampling stations
Treatments
N = Nuggets
A = Arborist chips
M = Medium bark mulch
C = Control (no mulch)
Influent sampling


Synthetic Storm Events
Storm size (inches)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.2
0.8
0.4
1.0
0.6
0.5
Mar-20
Apr-20
May-20
Jun-20
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21


403

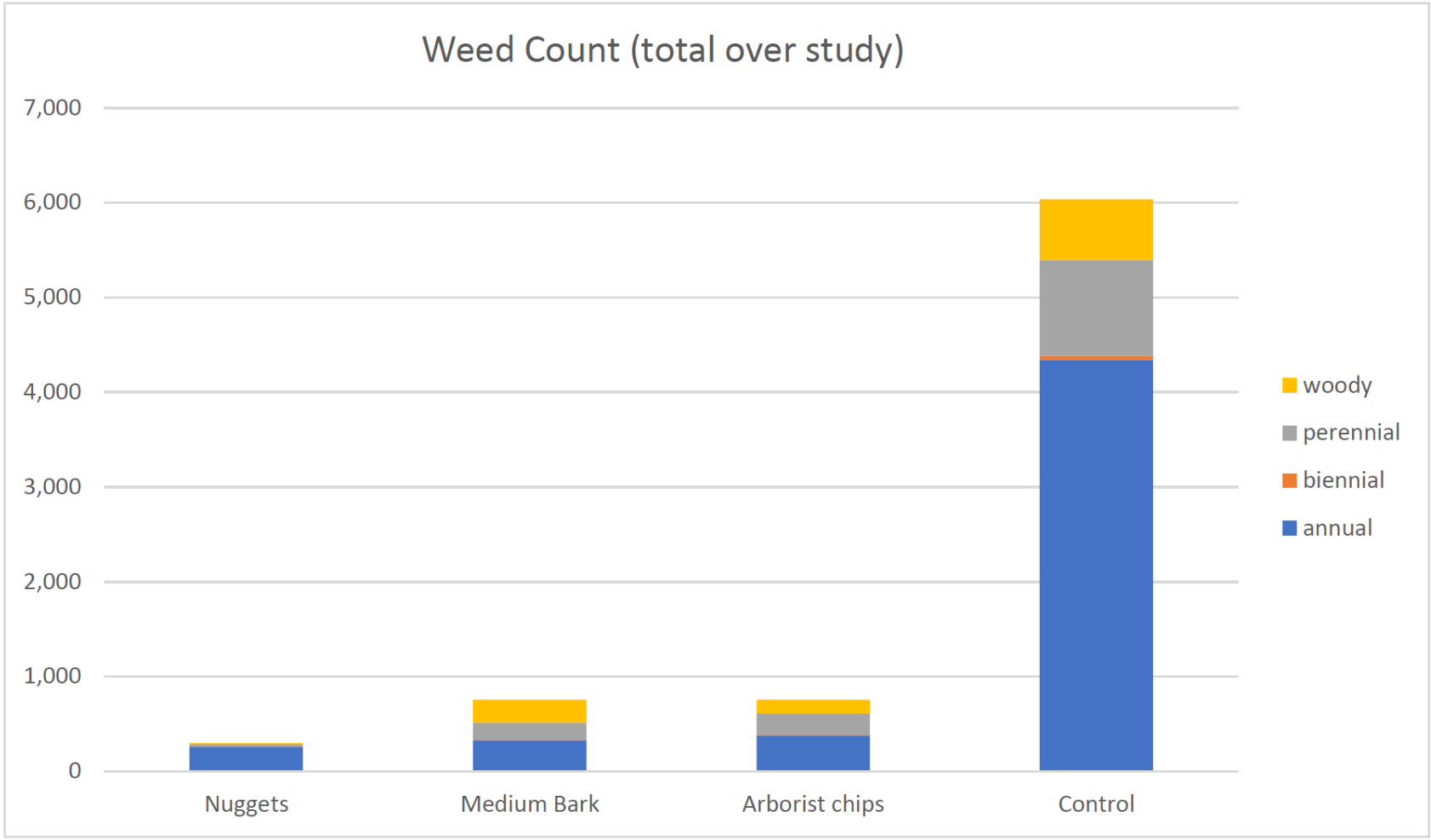
Results


Weeding Time (total hours)
72:00:00
60:00:00
48:00:00
36:00:00
24:00:00
12:00:00
0:00:00
30:40:00
38:55:00
40:25:00
67:35:00
Nuggets
Medium Bark
Arborist Chips
Control
Total

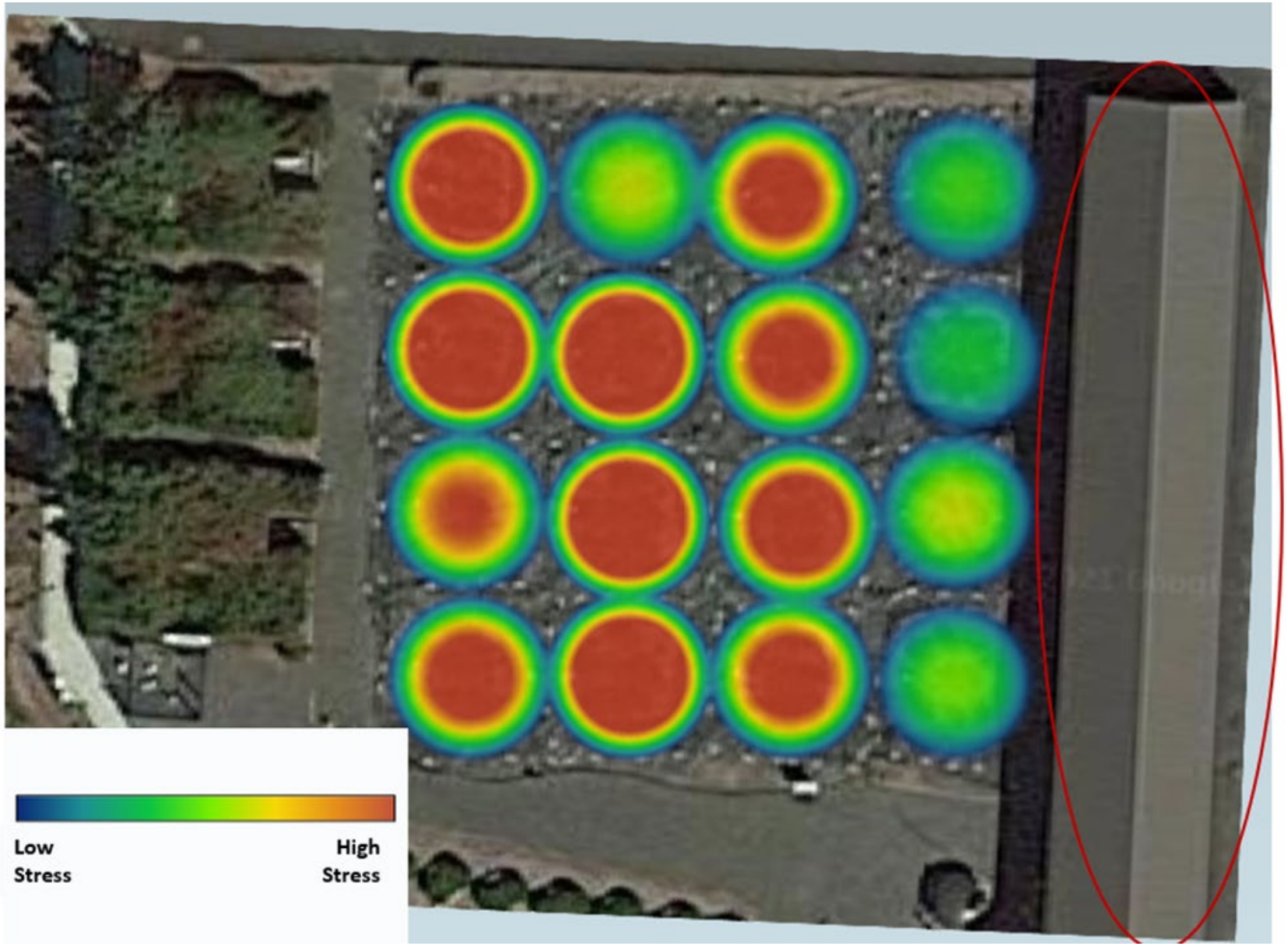
Weeding times

	Total per cell over 20 months (hrs.)	Ave. area weeded per cell (ft^2)	Effort per cell (min./ft^2/yr.)	Percent less than controls
Control	16.9	104.3	5.8	0%
Medium Bark	9.7	109.4	3.2	45%
Arborist	10.1	126.2	2.9	51%
Nuggets	7.7	114.3	2.4	59%

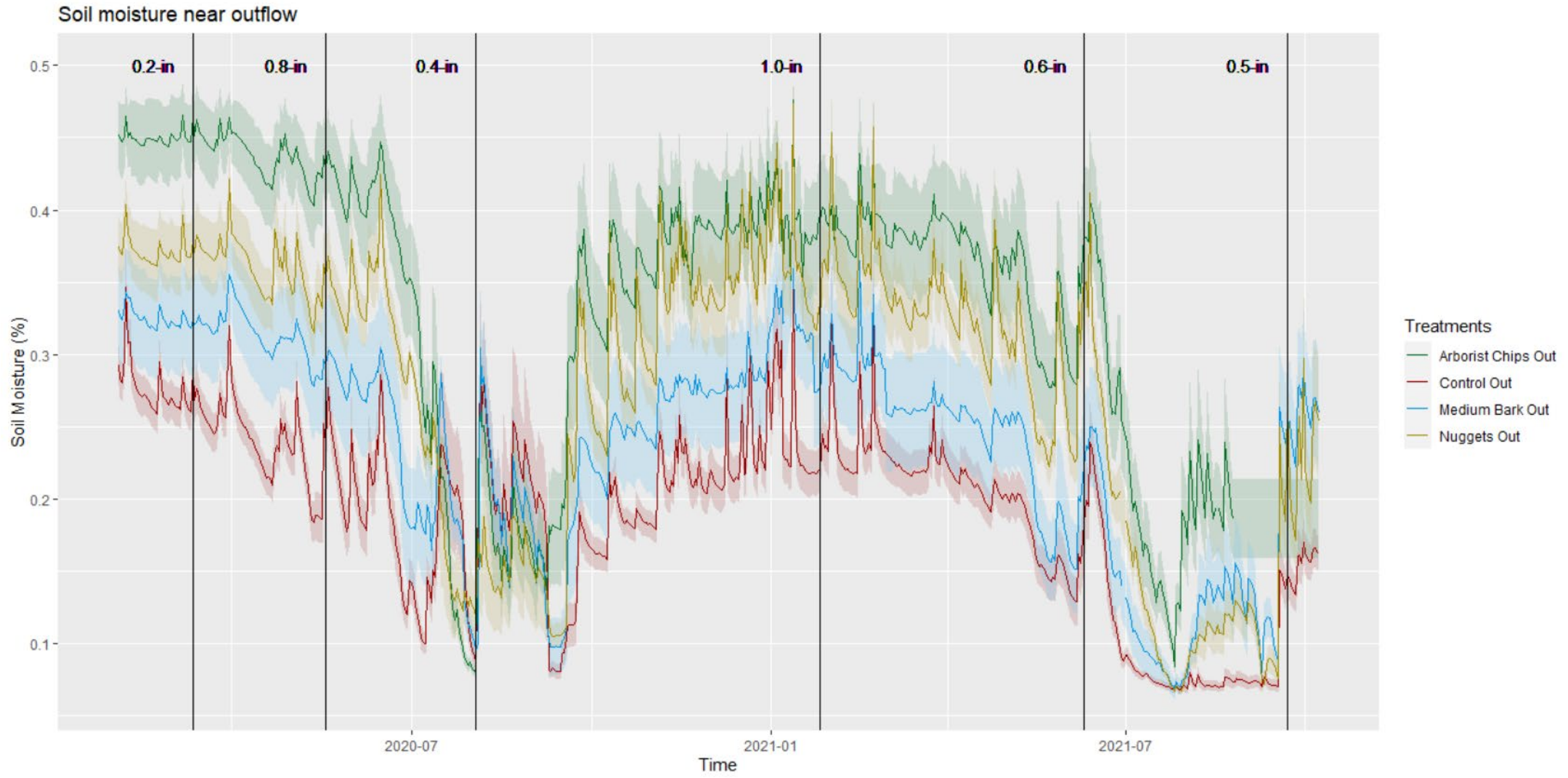
Weed Counts

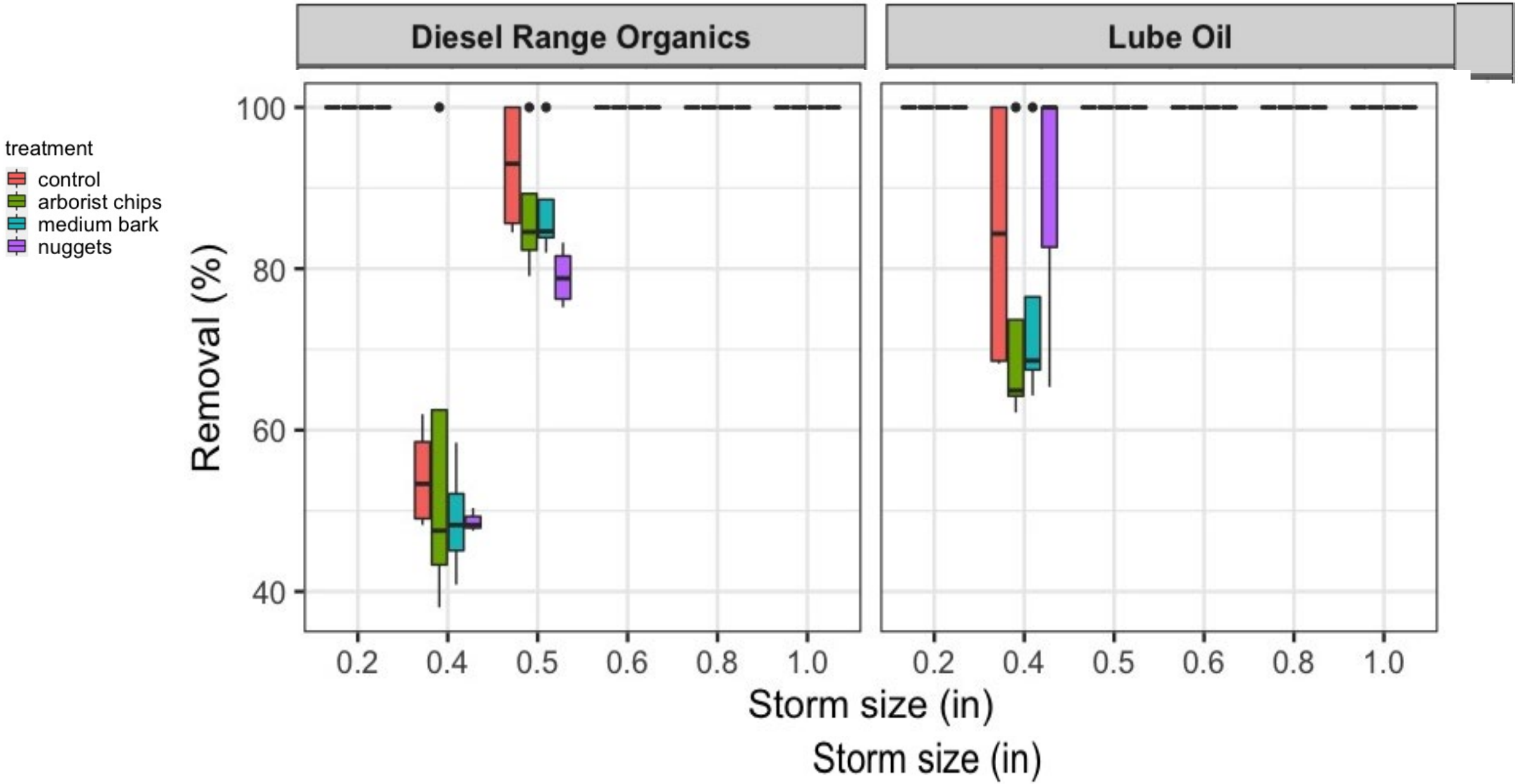

Weed Count (total over study)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Nuggets
Medium Bark
Arborist chips
Control
woody
perennial
biennial
annual

Shade Effects



Soil Moisture - effluent




Diesel Range Organics
Lube Oil
treatment
control
arborist chips
medium bark
nuggets
Removal (%)
100
80
60
40
0.2
0.4
0.5
0.6
0.8
1.0
Storm size (in)
Storm size (in)

Summary

- Mulch is a critical component in reducing weeding effort. Doubling of weeding time needed with no mulch.
- All three mulches performed similarly for weed suppression, with nuggets performing marginally better than medium bark and arborist chips.
- Mulch plays a critical role in preserving soil moisture in bioretention cells. Arborist chips had the greatest ability to maintain soil moisture.
- Couldn't distinguish water quality effects of just mulch.
- Nitrite-Nitrate (N-N) concentrations in bioretention effluent were generally lower in the presence of mulch compared to the no-mulch controls.

Thank you!

- Technicians: Carly Thompson, Brandon Boyd, Julie Gentzel, Susan Stuart – data collection, sensor maintenance, preliminary data analyses
- Graduate student: Chelsea Mitchell –data analyses
- Coordination and oversight – Brandi Lubliner, SAM Ecology

Questions?