

Biochar additions to
Denitrifying Bioreactors
and Ag Treatment
BMPs

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Ridge to Reefs' approach to addressing threats

➤ Science based approach

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➤ Visioning



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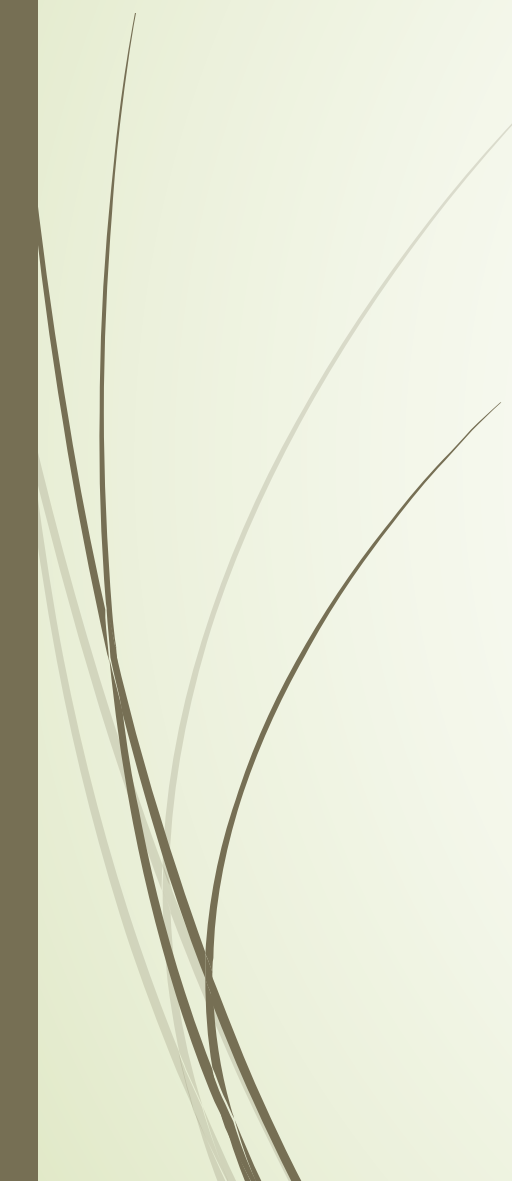
➤ Action and Engagement


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1. Create Conditions for Natural Treatment Processes

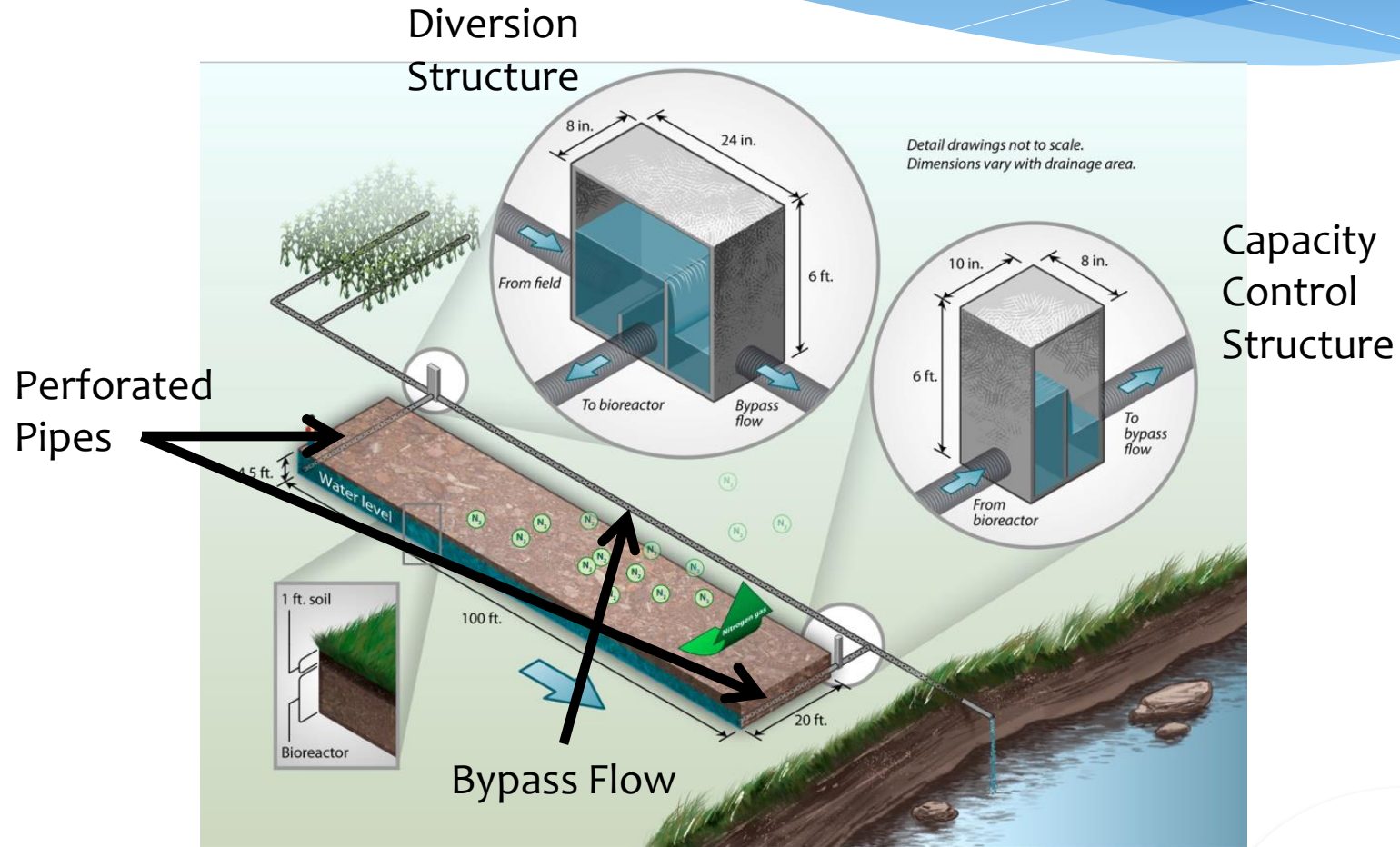
- ▶ Bacterial denitrification – mimic natural habitat and processes
 - ▶ Filtration and incorporation – sand, biochar, other media
 - ▶ Vegetation -- Evapotranspiration, biofilms
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Woodchip Bioreactor Basics

Components





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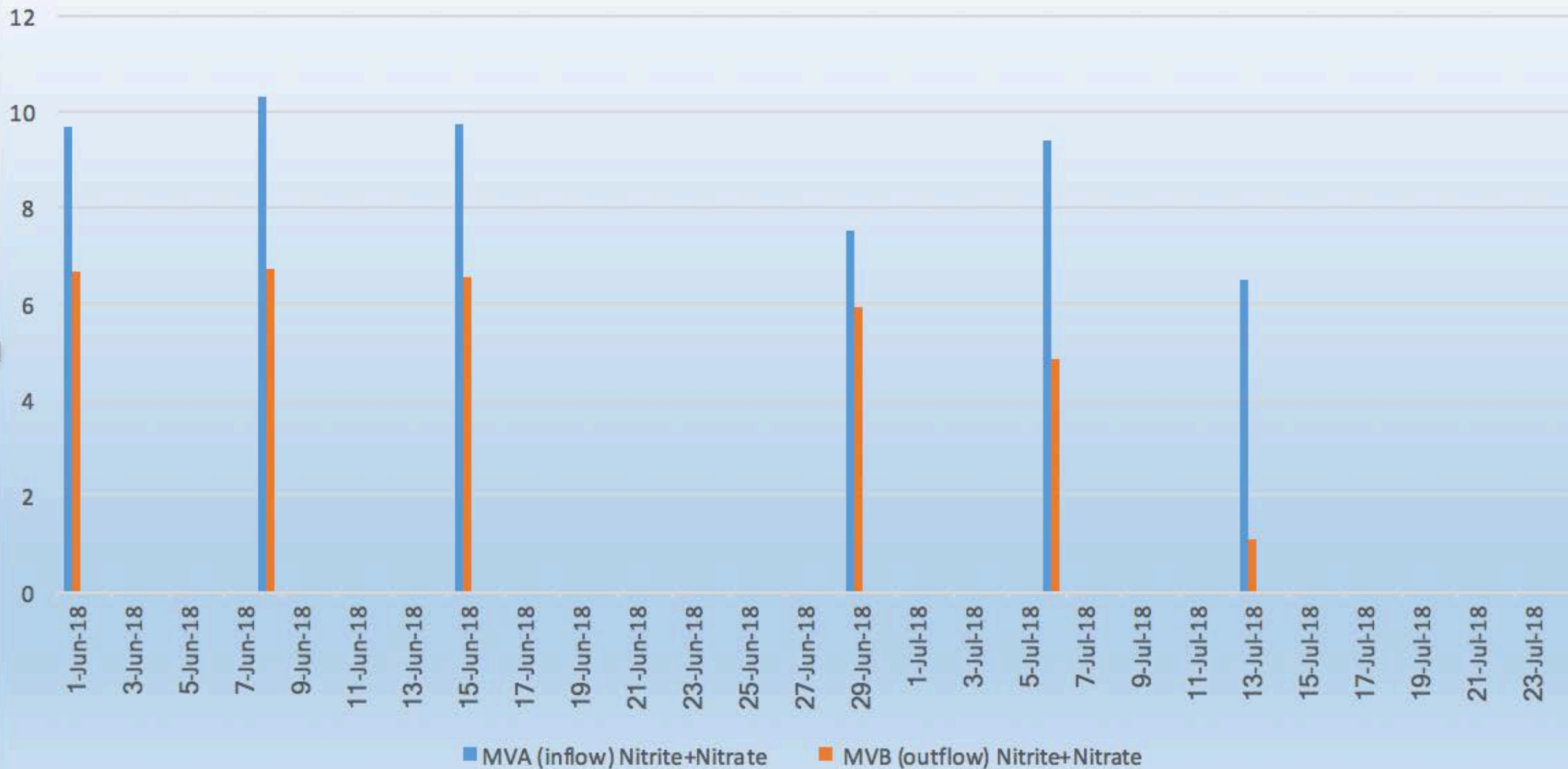
Meadow View Farm Nitrate Monitoring

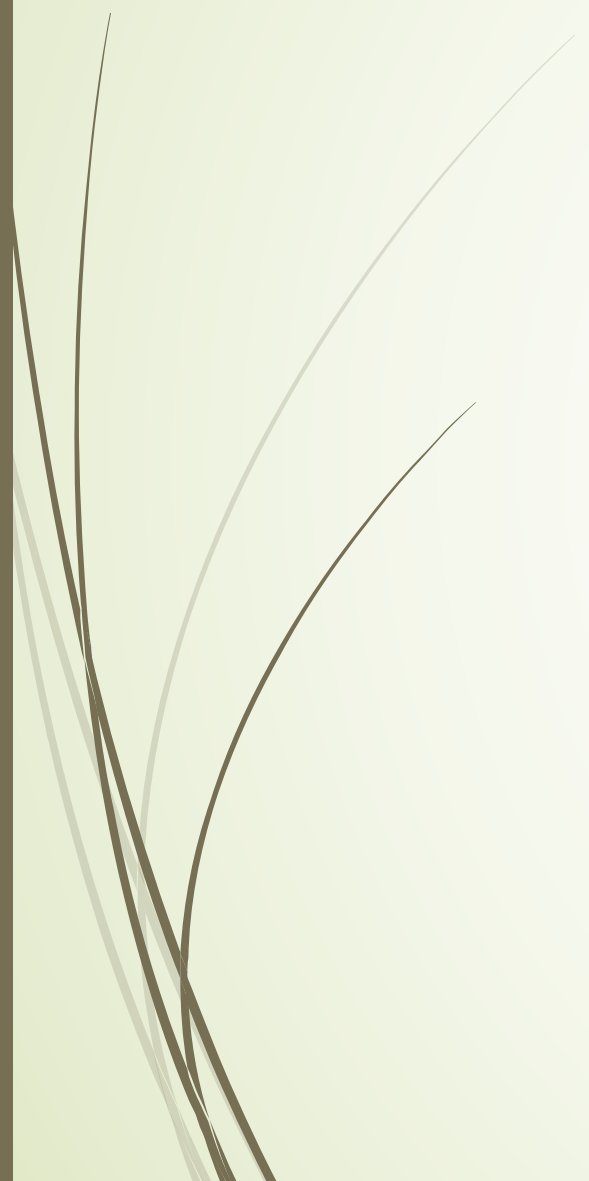
Date	Inlet NO3 mg/l	Outlet NO3 mg/l	Reduction %
12/16/16	9.9	2.32	77%
1/2/17	7.5	0.0	100%
1/5/17	8.3	0	100%
2/1/17	9.3	0.2	98%
2/16/17	8.9	0.2	98%
2/22/17	9.2	0.2	98%
2/27/17	8.3	0.2	98%
3/6/17	8.2	0.2	98%
3/13/17	9	0.2	98%
3/20/17	8.4	0.2	98%
3/27/17	10.8	0.2	98%
4/3/17	12.7	0.2	98%
4/10/17	12.2	0.2	98%
4/19/17	14.3	0.2	99%
4/24/17	11.7	0.2	98%
5/2/17	11.1	0.2	98%
5/8/17	10.7	0.2	98%
5/15/17	10.6	0.2	98%

Nitrite + Nitrate (Longer Detention Time) December 2016 - May 2017



Nitrite -Nitrate Summer 2018 After Increasing Flow Via Flashboard Riser







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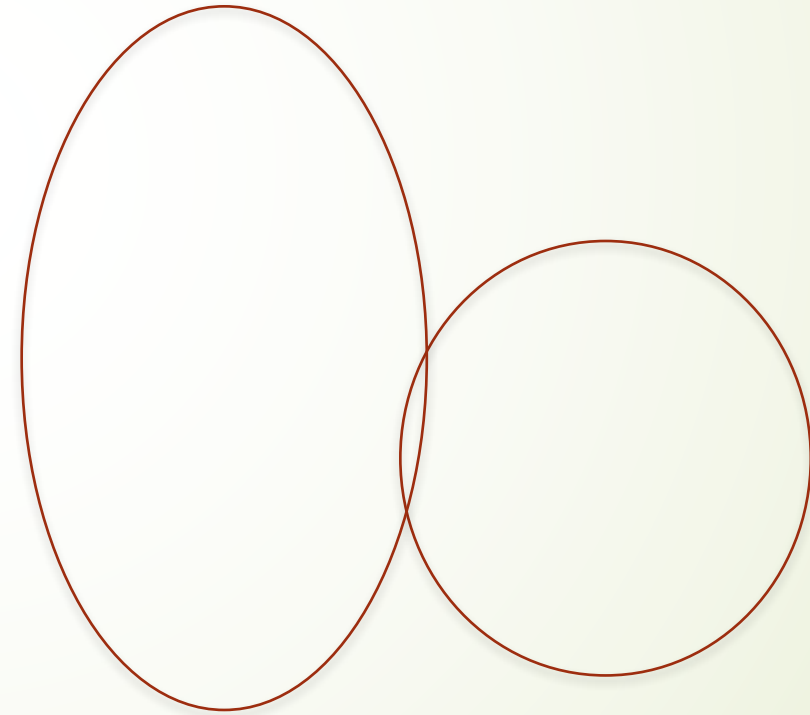


Denitrifying Bioreactors Evolution

- ▶ G1 – Woodchips – handled mostly nitrate
- ▶ G2 -- P-slag filter then a Bioreactor in series (improvements for P but not long lasting)
- ▶ G3 – Bioreactor with Biochar (1 integrated practice) – removes Nitrate, ammonia and dissolved P

Woodchip and Woodchip/Biochar Bioreactors P-Removal

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VA TECH COOP EXT BSE-55P

Meadowview Farms Total Phosphorus Sampling



Date	Total P (Inflow)	Total P (outflow)	Export
16-Dec-16	0.05	0.82	1540.00%
19-Dec-16	0.05	0.33	560.00%
2-Jan-17	0.06	0.76	1166.67%
5-Jan-17	0.05	0.16	220.00%
12-Jan-17	0.05	0.13	160.00%
19-Jan-17	0.05	0.07	40.00%
1-Feb-17	0.05	0.08	60.00%
16-Feb-17	0.07	0.12	71.43%
1-Jun-18	<0.05	<0.05	0.00%
8-Jun	<0.05	<0.05	0.00%
15-Jun	<0.05	<0.05	0.00%
29-Jun	<0.05	<0.05	0.00%
6-Jul	<0.05	<0.05	0.00%
13-Jul	0.23	0.2	-13.04%
24-Jul	0.77	0.25	-67.53%

Denitrification/Biochar Curtain at Ka'anapali Golf Course

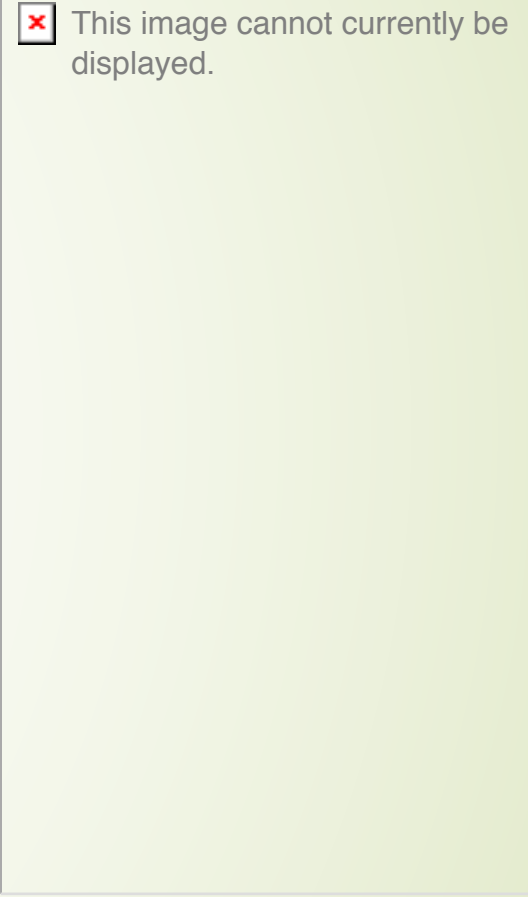
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3. Combine Biochar with Vegetative Treatment Practices = Green Infrastructure



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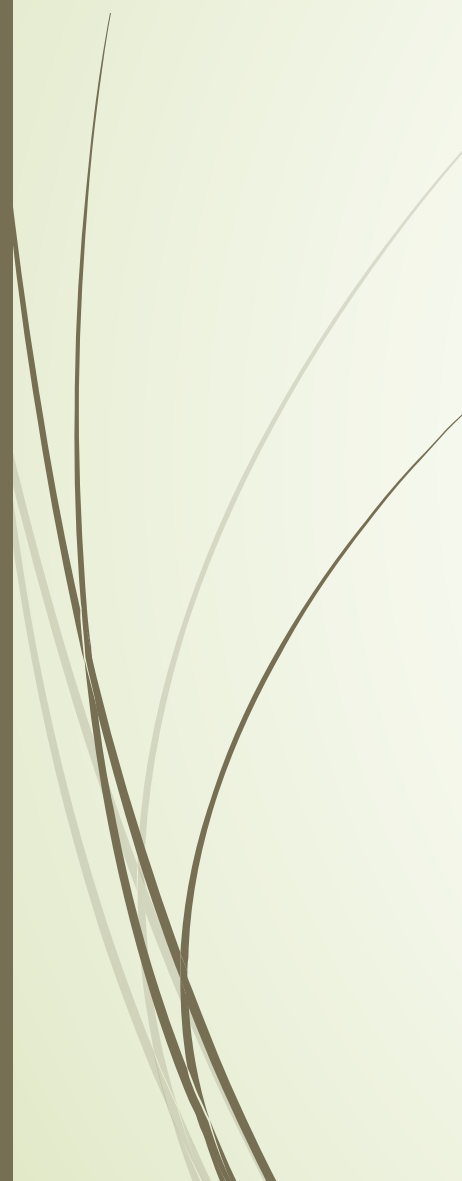
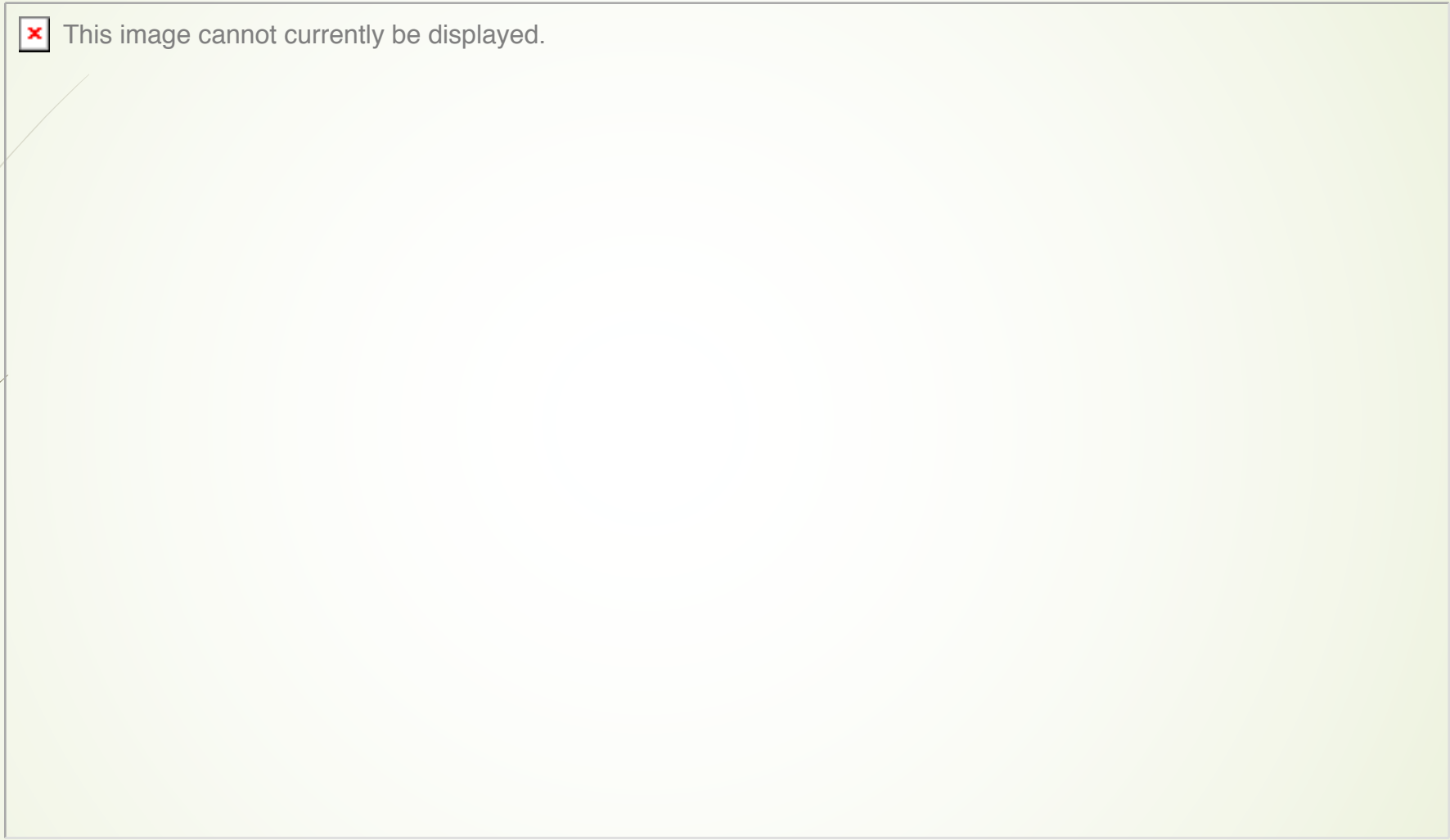




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(Truong and Hart, 1991)



Mt. Alava Elementary School – Pre-K Vatia, American Samoa



Small Piggery in American Samoa









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