U.S. DEPARTMENT OF ENERGY | Legacy Management

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Reducing costs of ecological restoration at the Hanford Site: Using native species to control weeds and technology to reduce greenhouse propagation costs

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Track 2: Advancing science and technology to reduce costs while maintaining or improving protection of human health and the environment

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Abstract

- Using native plants for revegetation, as part of Long-Term Stewardship, has a long history at the Hanford Site. A landfill cover over nuclear wastes has been stable for 24 years even with changes in plant community composition after disturbance. Examples are given of a number of ecological restoration trials using many native species. Trials using numerous species can help reduce the costs of remediation by focusing on the species that are more successful especially those that can withstand weed competition. Long-term survivorship is discussed. The use of bulk soil moisture content sensors in small pots to automate greenhouse irrigation is discussed.

Prototype Hanford Barrier

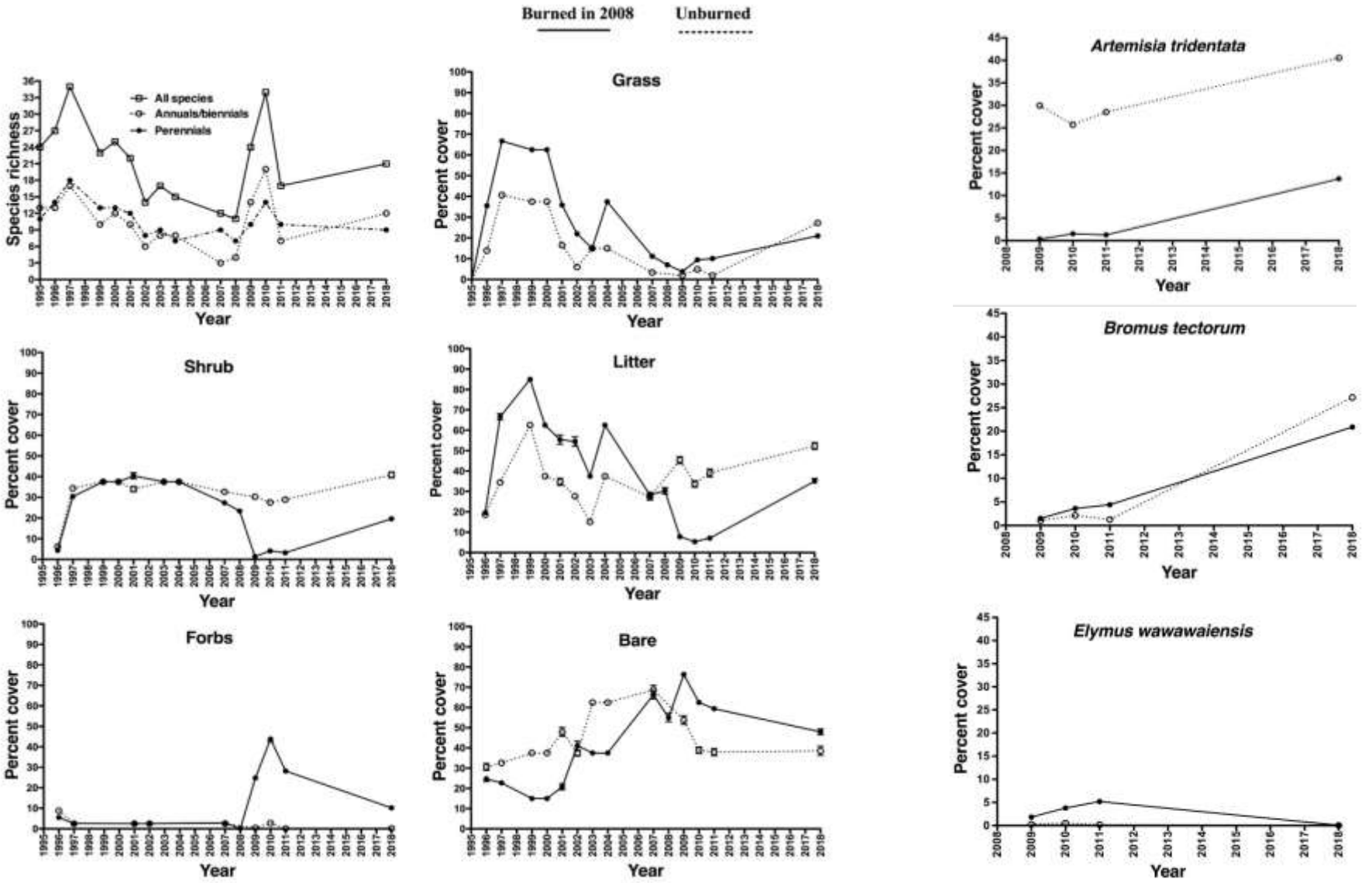
Burned

Unburned

The surface was revegetated in 1994 with 2 shrubs and 7 grass species.

Two shrub species remain while only 2 of the 7 grass species remain. The perennial grasses have failed.

Prototype Hanford Barrier



Prototype Hanford Barrier

2007 before fire in 2008
trace cheatgrass

2018 unburned
~ 27% cheatgrass cover

2018 burned
~20% cheatgrass cover

Ecological restoration trials

- Crested wheatgrass plantings
- many decades old are becoming
- infested with cheatgrass. Dense
- crested wheatgrass still appears to
- control cheatgrass.

Piper' s daisy were installed after a fire in 2011. The area is now infested with cheatgrass and Piper' s daisy has stopped expansion.

2018

2013

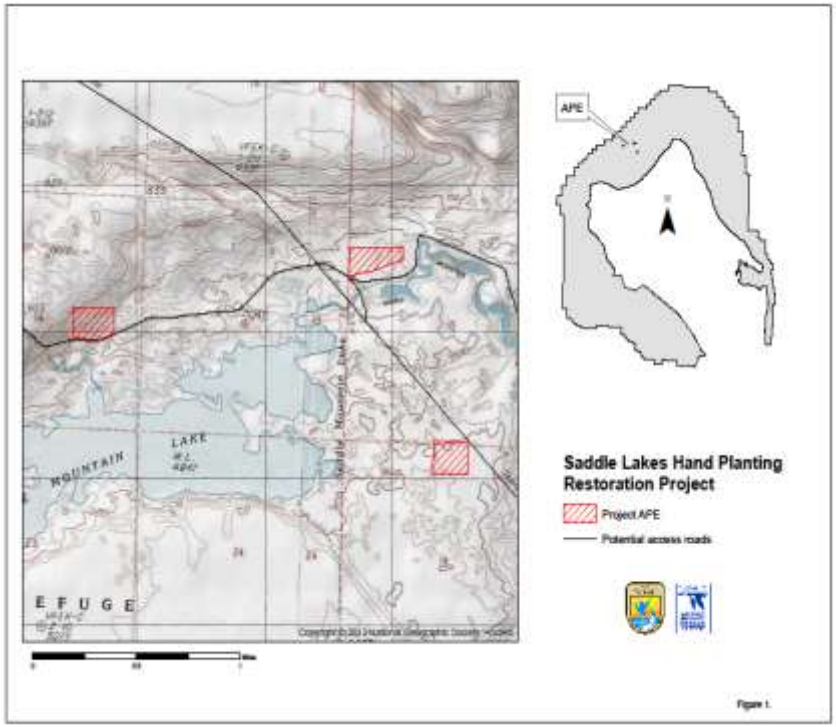
2018

Ecological restoration trials

Ten species installed in 2008.
Picture is in 2009.

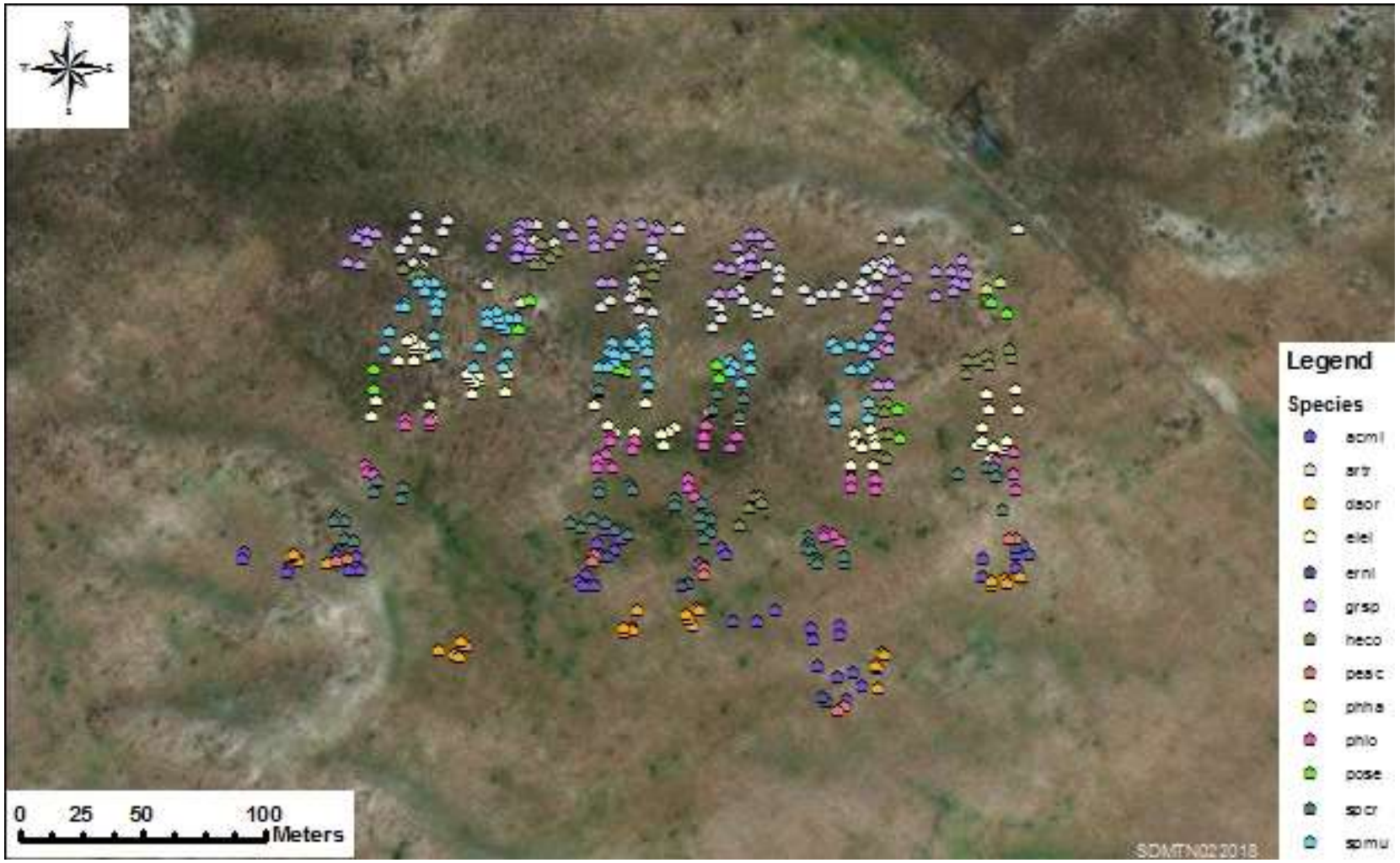
Only bitterbrush remained in 2016.

Ecological restoration trials with cheatgrass competition

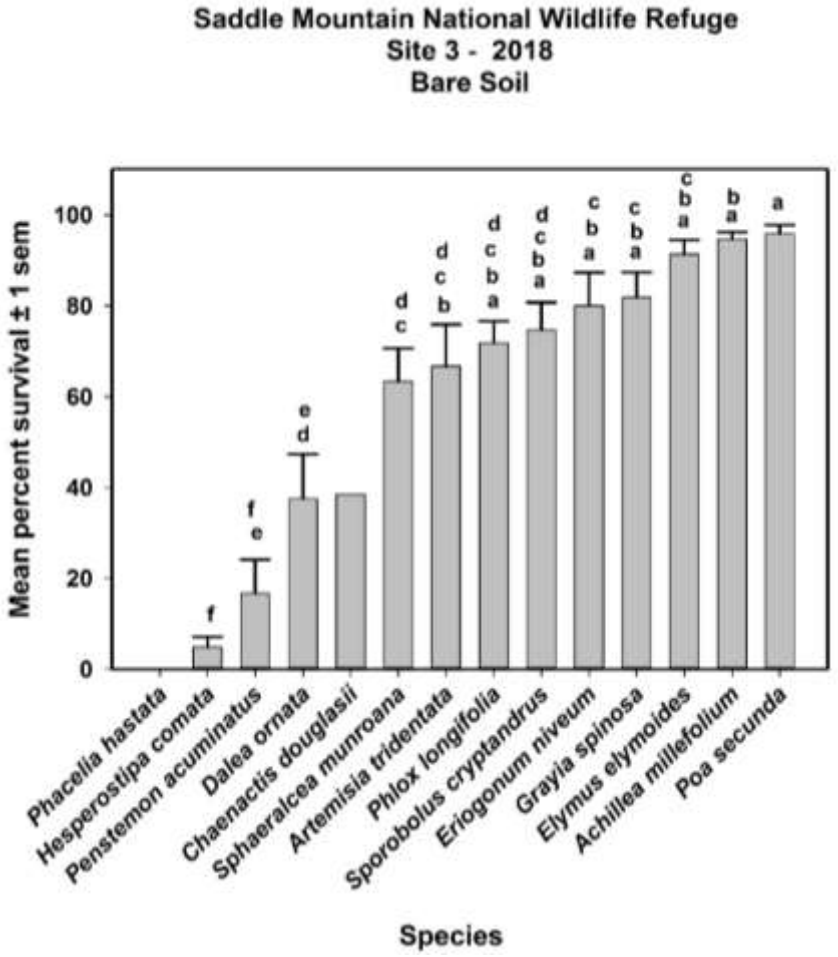


Fourteen native plant species were installed across 11 acres to determine how well they establish when planted into cheatgrass. Half the plants were installed in bare soil patches and the other half in cheatgrass.

Ecological restoration trials with cheatgrass competition

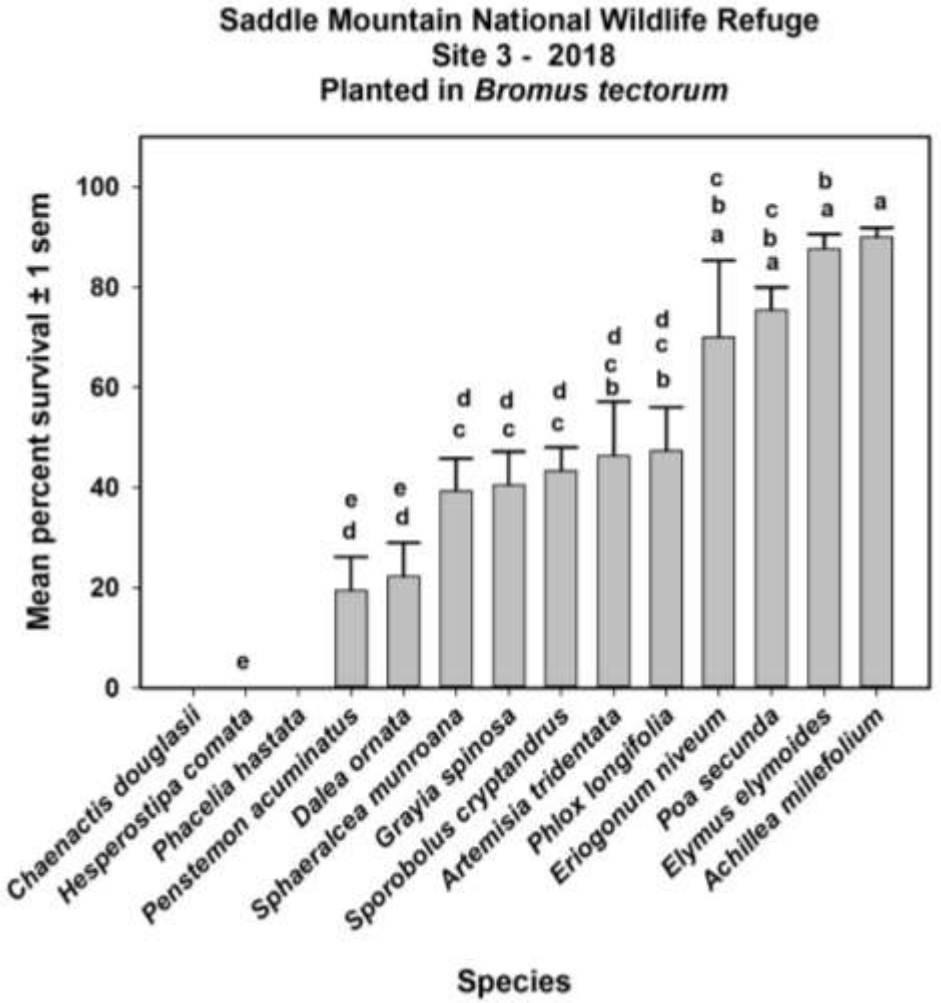


Ecological restoration trials with cheatgrass competition



Means with the same letters are not significantly different ($\alpha = 0.05$)

Ecological restoration trials with cheatgrass competition



Means with the same letters are not significantly different (⟨ = 0.05)

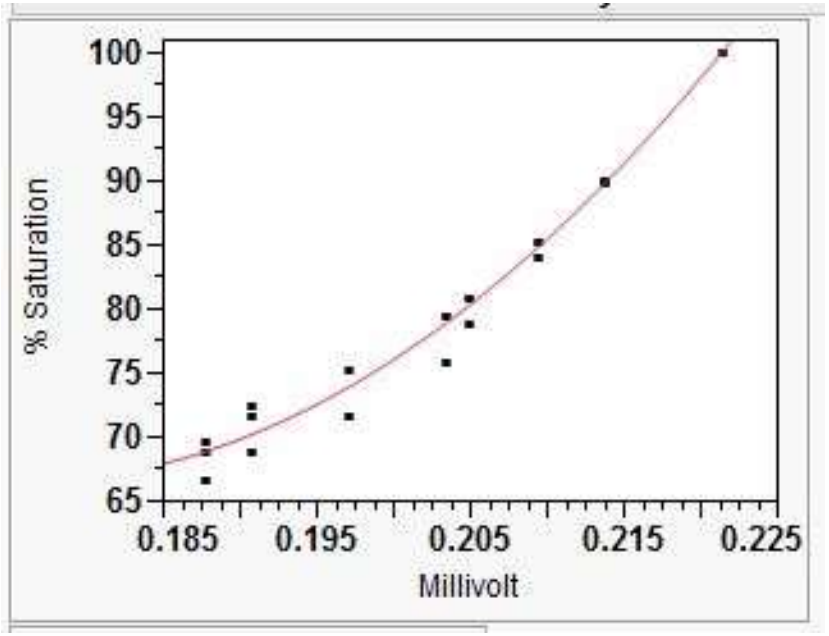
Ecological restoration trials with cheatgrass competition

Species	Installed in bare soil	Installed in *Bromus tectorum* dominated areas	Significance (α=0.05)
	% survival ± 1 sem n=6	% survival ± 1 sem n=6	
Achillea millefolium	95 ± 1.5	90 ± 1.9	0.085
Elymus elymoides	91 ± 3.2	88 ± 2.8	0.28
Poa secunda	96 ± 2.0	75 ± 4.6	0.0012
Eriogonum niveum	80 ± 7.3	70 ± 15.3	0.60
Phlox longifolia	72 ± 4.8	47 ± 8.6	0.0436
Artemisia tridentata	67 ± 9.2	46 ± 10.8	0.19
Sporobolus cryptandrus	75 ± 6.1	43 ± 4.6	0.0024
Grayia spinosa	82 ± 5.6	40 ± 6.6	0.0008
Sphaeralcea munroana	63 ± 7.3	39 ± 6.4	0.0333
Dalea ornata	38 ± 9.8	22 ± 6.7	0.21
Penstemon acuminatus	17 ± 7.5	19 ± 6.7	0.84
Hesperostipa comata	5 ± 2.3	0	0.08
	n=1	n=1	
Chaenactis douglasii	38	0	
Phacelia hastata	0	0	

Ecological restoration conclusions

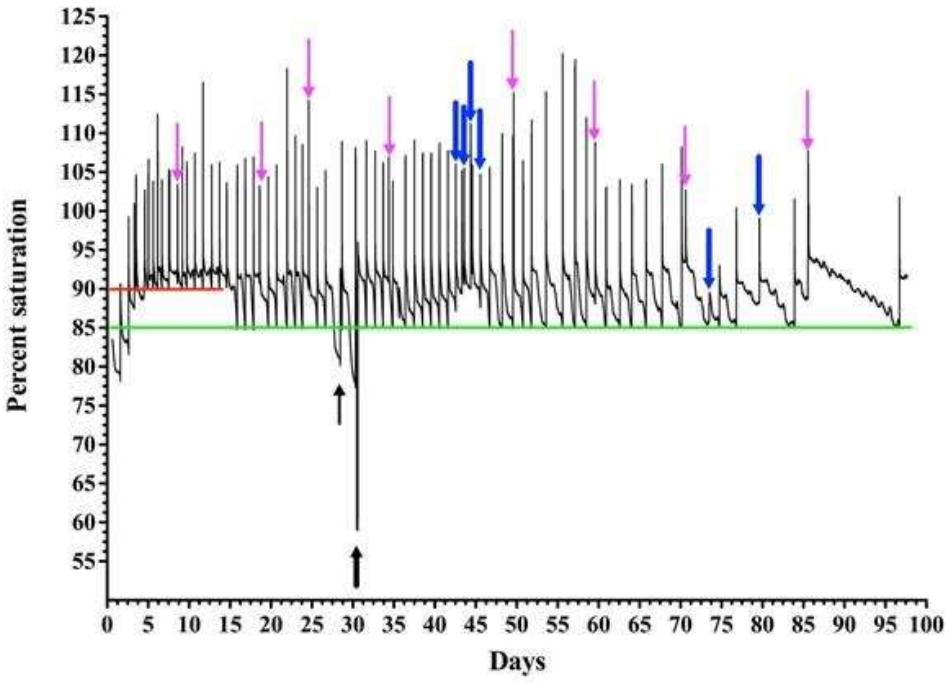
- Cheatgrass appears to be winning.
- Native bunchgrasses can control cheatgrass in wetter areas, but at the lower elevations at Hanford the native bunchgrasses that can control cheatgrass are, perhaps, not working in the long-term. More research is needed.
- Classical control after wildfire, herbicides, and drill seeding bunchgrass can cost ~$1500/acre, but may not sustain themselves against cheatgrass.
- Efforts to control cheatgrass in our efforts include testing the effect of additional carbon, bacteria, installing native species that may outcompete cheatgrass, and hand drill seeding.
- Efforts at increasing species diversity in cheatgrass communities may be improved by breeding native species to have more resistance to cheatgrass. If populations can expand with cheatgrass competition then some First Foods value can be returned to these areas. This cost is to be determined.

Automating greenhouse irrigation

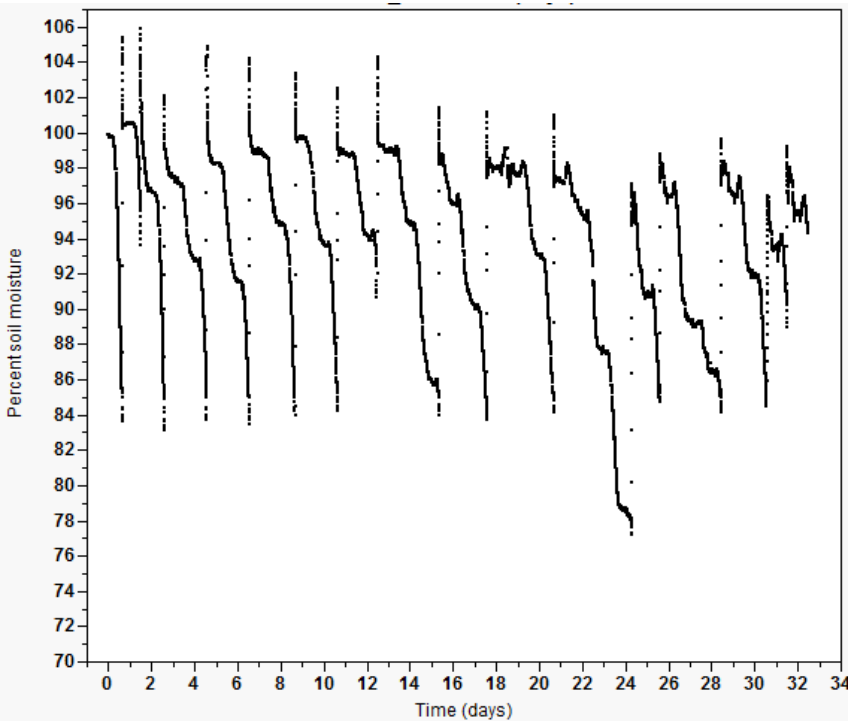


Automating greenhouse irrigation
Soil moisture control – Summer 2017 and 2018

2017



2018



Automating greenhouse irrigation

•Weighing racks of pots now only needs to be done during sensor calibration.

•Sensor and data logger plus set-up cost is ~$7,000.

•Reduces labor to manually weigh racks to determine water content. For example, if 1 hour were required per day to weigh racks and the average cost of labor is $20.00 per hour then the investment is recouped in 350 days.

•The automated system has the additional advantage that it monitors water content 24/7 which reduces the need for scheduling workers on weekends and holidays.