Horse Creek Conservation Seeding

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In the summer of 2010, USDA, Agricultural Research Service, Great Basin Rangelands Research Unit teamed up with the Horse Creek Ranch, Wildfire Conservation Group, University Nevada Reno and the USDA-ARS Range and Forage Pasture Unit out of Logan, Utah to address the issues of rehabilitating degraded big sagebrush communities and to improve wildlife and livestock forage on these degraded habitats. In 2010 the Horse Creek Ranch provided 80 acres of land to conduct a number of treatments and trials. The site was dominated by weeds and decadent brush, providing poor forage and high risks of fire.

Site Map


OREGON
Winnemucca
Elko
Reno
CARSON CITY
NEVADA
Las Vegas


2011 Plant Material testing
2011 Single mix seeding, Forage Kochia seed storage test
Exclosure
2012 Logan Utah ARS Plant Material testing,
2013 Reno ARS seeding
2012 Single mix seeding,
2013 Re-seeding
2014 green strip seeding
Entrance

Timeline of Activities

September 2010 - Disced 40 acres

October 2010 - Small plot Plant Material test seeding , No-till drill 10 acres
- Rehabilitation single mix seeding, Rangeland drill 20 acres
- Forage kochia seed storage test- Broadcast and No-till drill 20 acres

April 2011 - Disced 40 acres
- Cheatgrass Roundup® control 10 acre exclosure

October 2011 - Rehabilitation single mix seeding, Rangeland drill 40 acres*
- Logan, Utah ARS Plant Material seeding ~1 acre

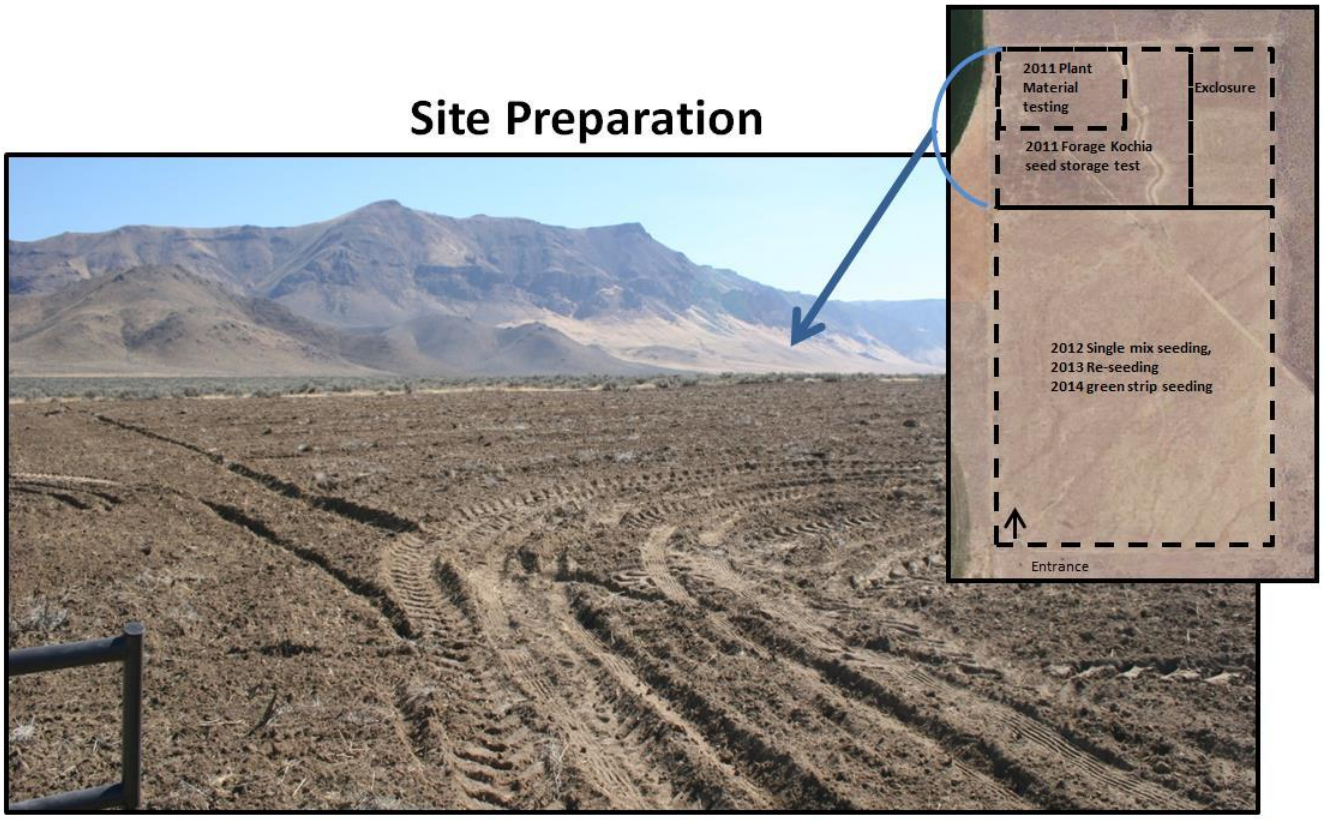
May 2012 - Broadleaf herbicide 2-4D control 40 acres*
- Broadleaf herbicide 2-4D control 10 acre exclosure

October 2012 - Re-seeding rehabilitation single mix seeding No-till drill 40 acres*
- No-till drill single mix seeding 10 acre exclosure

October 2013 - Rehabilitation single mix seeding No-till drill – Greenstrips*

* represents the same 40 acres initially seeded in 2011

Site Preparation



In September of 2010, approximately 40 acres were disced prior to seeding efforts. This provided multiple benefits. It decreased soil compaction of the seedbed, eliminated the brush and buried a large portion of weed seeds below germination depth. The optimal time of discing would have been April to kill the weeds before seed production, but project constraints did not allow for it.

Even with discing, cheatgrass competition was immense after seeding efforts.

First Growing Season (Oct 2010- Oct 2011

The fall and winter (October thru February) of 2010/2011 provided excellent precipitation, 5.75", in which fall germination and sprouting of perennial grasses and forage kochia species occurred. This is a rare event, in the 25 years we have been conducting these seedings, we have only witnessed this one other time.

Following the seeding of 'Immigrant' forage kochia, frequent snow events occurred to allow for excellent seed stratification conditions. With this event also came winter mortality of seedlings from frost heaving.

Fall and spring germination resulted in dense stands of cheatgrass. This density of cheatgrass no doubt influenced the mortality of less competitive seeded species.

No-till Drill Seeding and Plant Material Testing

During the second week of October 2010 we drill seeded various plant material

Grass Species	Status	Rate(acre) / Cost (lb)	Established
Sherman Big Bluegrass *Poa ampla*	Native	2 lbs 7$	No
Thickspike Wheatgrass *Elymus lanceolatus*	Native	7 lbs 10$	No
'Secar' Bluebunch Wheatgrass *Elymus wawawaiensis*	Native	7 lbs 10$	No
Bottlebrush Squirreltail *Elymus elymoides*	Native	7 lbs 20$	Yes < 10 plants
'Whitmar' Wheatgrass *Pseudoroegneria spicata*	Native	7 lbs 15$	No
Creeping wildrye *Leymus triticoides*	Native	10 lbs 20$	No
Needle and Thread *Stipa comata*	Native	7 lbs 60$	No
Desert Needle grass *Stipa speciosa*	Native	7lbs 45$	No
'Hycrest' Crested Wheatgrass *Agropyron critsatum*	Introduced	7lbs 4$	Yes
'Nordan' Crested Wheatgrass *Agropyron desertorum*	Introduced	7 lbs 4$	Yes
'Ephraim' Crested Wheatgrass *Agropyron cristatum*	Introduced	7lbs 5$	Yes
Siberian Wheatgrass *Agropyron fragile*	Introduced	7lbs 5$	Yes
Bozoisky I & II Russian Wildrye *Psathyrostachys junceus*	Introduced	7lbs 7$	No
'Amur' Intermediate wheatgrass *Thinopyrum intermedium*	Introduced	9 lbs 7$	Yes 1 plant
Tall wheatgrass *Thinopyrum ponticum*	Introduced	9 lbs 4$	Yes < 5 plants

Shrub Species	Status	Rate (acre)/ Cost (lb)	Established
Shadscale *Atriplex confertifolia*	Native	4 lbs 10$	No
Four-wing Saltbush *Atriplex canescens*	Native	4 lbs 15$	No
Gardners saltbush *Atriplex garderni*	Native	4 lbs 10$	No
'Immigrant' Forage Kochia *Kochia prostrata ssp. virescens*	Introduced	2 lbs 20$	Yes
'Snowstorm' Forage Kochia *Kochia prostrata ssp. grisea*	Introduced	2 lbs NA	Yes

Forb Species	Growth	Rate(acre)/ Cost (lb)	Established
Lewis Flax *Linum lewisii*	perennial	1 lbs 15$	No
Western Yarrow *Achillea millefolium*	perennial	0.5 lbs 60$	No
Baily's Buckwheat *Eriogonum bailyii*	Annual	0.5 lbs NA	No
White stem stickleaf *Mentzelia albicaulis*	Annual	0.5 lbs NA	No
Desert pincusion *Chenactis stevoides*	Annual	0.5 lbs NA	No
Silver scale saltbush *Atriplex argentia*	Annual	0.5 lbs NA	No

Each species was seeded using a small Kincaid no-till drill for a 200ft pass. Squirreltail and bluebunch wheatgrass included tests of commercial and locally collected seed sources.

No-till Drill Seeding and Plant Material Testing

Initial spring seedling emergence revealed that the native shrubs and forbs were very unsuccessful, 0-0.3/ft², whereas 'Ephraims' and 'Nordan' crested wheatgrasses and Siberian wheatgrass experienced the best success at 8.7-9.7/ft². 'Snowstorm' forage kochia did perform quite well, but do to the drought this highly nutritional forage is being heavily browsed by the deer and the local rabbit population. By September 2011 these three top perennial grass performers had been reduced to 3.3-5.7/ft², and by September 2012 were significantly reduced to 0.10-0.70/ft². With fall germination also came the germination of cheatgrass which averaged 23.4/ft².

'Ephraims' wheatgrass seedling emergence

Lewis flax seedling emergence.
No seedlings survived the first year

Siberian Wheatgrass with cheatgrass competition

'Snowstorm' forage kochia seedlings

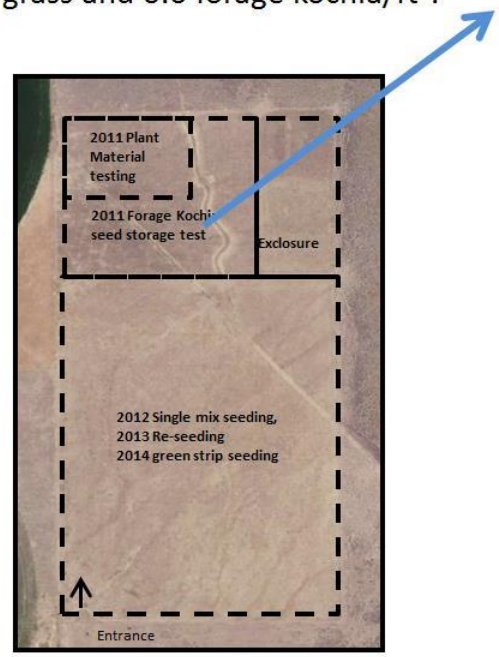
Large Plot Rangeland Drill Seeding 2010-2011

We also seeded a larger area (~ 20 acres) with a mixture of Siberian wheatgrass (4 lbs/acre rate), 'Hycrest' crested wheatgrass (4 lbs/acre rate), and 'High Plains' big bluegrass (0.20 lbs/acre rate). This seeding was followed up with the no-till drill and broadcast application of 'Immigrant' forage kochia to test the results of using newly collected "fresh" seed versus previously collected "cold storage" seed.

Rangeland drill with depth bands

Kochia broadcast and no-till drill

The larger seeding resulted in mix results depending on location. The quadrats at the lower end of the seeding site closer to the agricultural fields yielded very limited results and only got worse over-time, 0.2 perennial grass and 0.3 forage kochia/ft². The upper quadrat locations experienced excellent recruitment of seeded species, 2.6 perennial grass and 0.6 forage kochia/ft².



Perennial grasses 'Hycrest' crested wheatgrass and Siberian wheatgrass in association with 1-year old, cold-storage 'Immigrant' forage kochia.

Cold storage Forage Kochia Seed Test

Testing the methodology of using “fresh’ versus “cold storage” ‘Immigrant’ forage kochia seed yielded that the 1-year old cold-storage seed source plots averaged 0.48/ft² (4.3/m²) and the fresh seed plots average 0.73/ ft² (6.6/m²). There was no difference in the broadcast seeding versus no-till drill seeded plots.

‘Immigrant” forage kochia seeding plots: “fresh”, on the left and “cold storage”, on the right.

October 2013 established ‘Immigrant” forage kochia (red) with seed production

Cheatgrass and Seedling Monitoring

Along with Fall germination the spring (March thru June 2011) was quite wet as well as the site received just over 4" of precipitation. Cheatgrass density and height was such a problem in 2011 it became very difficult to monitor seedlings of seeded species. In fact, observers called the project a failure so we mowed cheatgrass throughout our quadrat locations so the litter would blow away and we could more accurately record seeded species.

November 2010 cheatgrass emergence

June 2011 Perennial grass seedlings after mowing

Could we have predicted the amount of cheatgrass…? Yes

See how on the next page

Seed Bank Monitoring

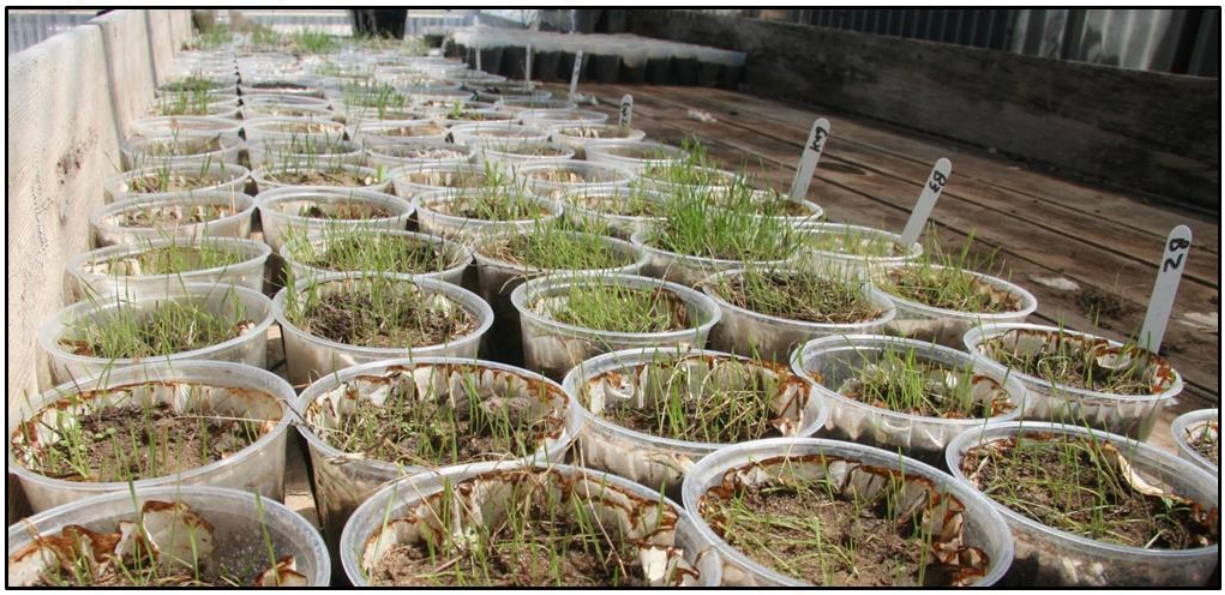
Bioassay Sampling identifies the number of viable seeds in the seed bank without having to perform laborious duties of sieving, collecting and counting each seed. The **bioassay techniques** we use were developed in England in the late 1800s and refined by James A. Young, Raymond Evans and Dick Eckert in the mid 1960s. It is an excellent tool to alert the land manager on just what is in the seed bank as well as how effective their weed control program has been. Here is a brief description on how we perform our **bioassay sampling:** To start with, you will need a hand trowel, small plastic bags (e.g. 4"x4"x12"), and plastic cups (4" radius x 3"depth) with coffee filters. To randomly sample the site you are going to collect bioassay samples simply collect soil in a 4"x4"x2" area including the litter layer.

Square foot quadrat in which a 4"x4"x2" sample of soil is collected to sample the seed bank for viable seeds.

Place the soil sample in the plastic bag and tie the top of the bag so that no soil is lost and it is safe for transporting

The sample will fill a 16oz cup about ¾ full when plastic bags with soil are returned to a greenhouse

The number of samples collected depends on the available bench space available at the greenhouse you will be using to water these samples and record emergence. In a one acre plot we usually collect 80-100 samples.



Bioassay Seed Bank Sampling

Often we use 5 gallon buckets to transport the bioassay samples back to the truck for transport to the greenhouse. Make sure you mark the samples and then the cups to identify your samples (e.g. disced, undisced). Samples should not be left in plastic bags for more than a day or left in hot sunlight as to not kill seeds.

Disced soil (good weed control)

Un-Disced soil (No weed control)

The bioassay cups should have a small hole in the bottom of them for drainage (we just power drill small holes) and lined with a coffee filter if possible. Once you wet the samples real good you simply count emergence on the 7th day (pull the emerging seedlings with the seed still intact), continue to water and perform this task on the 14th day and 28th day. Following the recording of emerging seedlings that you have successfully pulled, you will have a total of the active seed bank for that sample. Multiply the recorded number per sample by 9 and this will give you the active seed bank/ft^2.

Agricultural Research Service Weather Station

Along with monitoring the biotic community (plants, seeds etc.), the Reno NV ARS unit installed a weather and soil monitoring station. Temperature (ambient and soil), wind, precipitation and solar radiance are recorded daily.

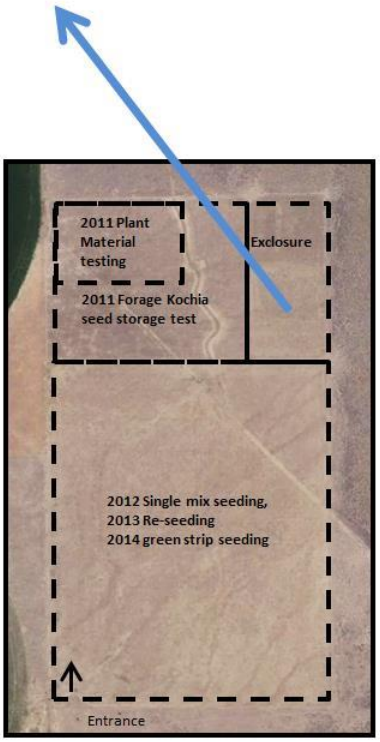
Weather Station includes:
HOBO U30 NRC data logger with 10 inputs
1.2W Solar Panel - SOLAR-1.2W
Temperature/RH Smart Sensor
TE525 tipping bucket rain gage
Wind Speed Smart Sensor
12-bit Soil Temperature Smart Sensor
Solar Radiation Shield for Temperature & RH sensor

The weather station also doubles as a bird perch!

ARS Range and Forage Pasture Unit Plant Material Testing

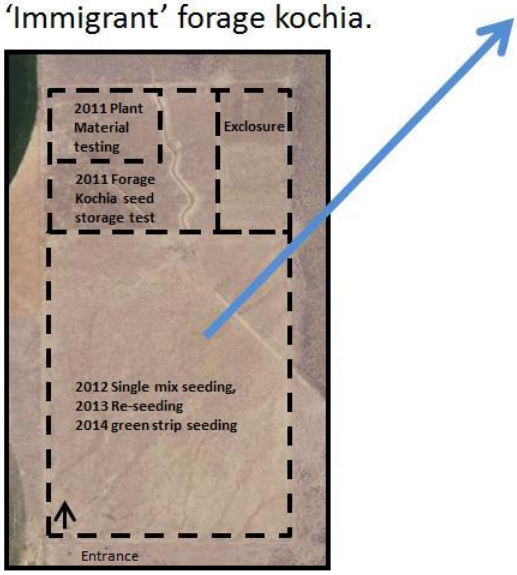
In the fall of 2011, The USDA-ARS, Range and Forage Pasture Unit out of Logan, Utah seeded 13 separate treatments of seed species to test some of their plant materials that they thought were best suited for this site following a summer weed control program which included the applications of Roundup (to control cheatgrass) and 2-4D (to control late summer Russian thistle emergence). Plots are 10' x 60' and are replicated 4 times, to test some of their plant material that they thought was best suited for this site. 'Valvolov II' Siberian wheatgrass performed the best for the perennial grasses, 0.43/ft² (3.9/m²), while 'Snowstorm' forage kochia yielded 0.02/ft² (0.14/m²).

King's River PMT Logan ARS Plots 5/1/2014 (plants/m²)					
Species	Rep I	Rep II	Rep III	Rep IV	Average
'Hycrest II' crested wheatgrass *Agropyron cristatum*	1.7	1	1.7	3	**1.9**
'Vavilov II' siberian wheatgrass *Agropyron fragile*	3.7	1	4	5	**3.4**
'Bozoisky II' russian wildrye *Psathyrostachys juncea*	0	0	0.3	0.3	**0.2**
Saltgrass *Distichlis spicata*	0	0	0	0	**0**
'Alkar' tall wheatgrass *Thinopyrum ponticum*	0	0	0	0	**0**
Valvilov II & ' Immigrant' Kochia *Kochia prostrata ssp. virescens*	4.3 0.02	2 0.02	5 0.1	4.3 0.02	**3.9** **0.04**
Vavilov II & 'Snowstorm'Kochia *Kochia prostrata ssp. grisea*	3 0.17	3.7 0.14	8.7 0.17	5.3 0.06	**5.2** **0.14**
Valvolov II & 'KZ6X' kochia *Kochia prostrata ssp. grisea*	4 0.07	2.3 0.06	4 0.13	5.3 0.08	**3.9** **0.09**
'Oahe' Intermediate wheatgrass *Thinopyrum intermedium*	0	0	0	0	**0**
'Trailhead' Basin wild rye *Lemus cenereus*	0	0	0	0	**0**
'Shashone' beardless wildrye *Leymus multicaulis*	0	0	0	0	**0**
Alkali sacatoon *Sporobolus airoides*	0	0	0	0	**0**
'Recovery' western wheatgrass *Pascopyrum smithii*	0	0	0.3	0	**0.08**

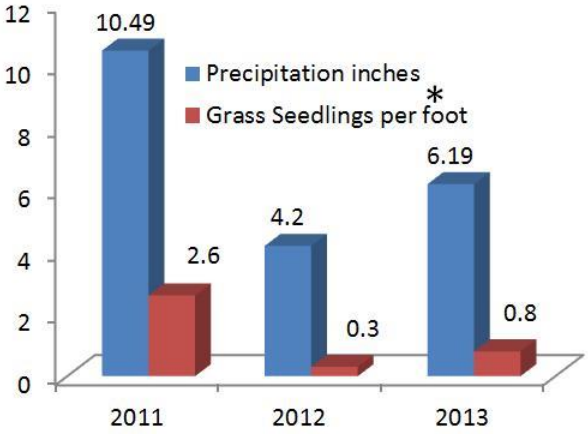


Large Plot Drill Seeding 2012-2013

In April of 2011 we disced and fallowed the remaining 40 acres and replicated the fall 2010 larger seeding. While the cheatgrass control from discing at the ideal time in April significantly reduced competition, the site only received 2.18" of fall and winter precipitation followed by 1.7" of spring precipitation and a *total of 4.2" of precipitation* from Oct 1, 2011 thru Sept 30, 2012 *compared to 10.49" the previous year*. Therefore, seedling counts were very poor, 0.3/ft², and the initial grass seedlings that showed promise were destroyed by an outbreak of the Black Grass Bug. In the fall of 2012 we reseeded the site and yielded initial seedling densities of 14.7/ft², but following another dry year, 6.19", seedling recruitment averaged 0.8/ft² of perennial grasses and 0.2/ft² of 'Immigrant' forage kochia.



Initial emergence of perennial grass seedlings at a very early stage in the spring of 2012 (left) These seedlings need to make it to the 2-3 leaf stage if they are to have a chance to establish at this site (right).



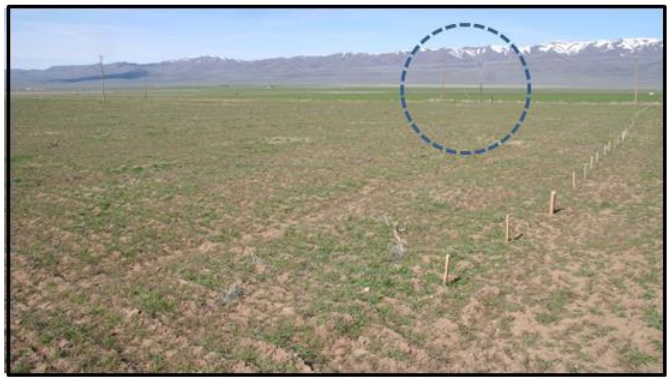
2012-2013 seeding applications experienced 4.2" and 6.2" of precipitation, respectfully, which has made it very difficult to recruit seeded species in these seeding efforts.

*represents seeding year, ex:2011 = Oct 2010 to Oct 2011

It is critical to establish an adequate density of long-lived perennial grasses to suppress cheatgrass densities and associated fuel loads, therefor decreasing the chance, rate, spread and season of wildfires.

Dec 2010. Sprouted perennial seeded grasses, A rare event to occur in fall, most commonly occurring in Feb-March

January 2011. Cold and snow provided good stratification for seeds to decrease dormancy and decreased rodent seed predation.



May 2011. Without good cheatgrass control prior to seeding, cheatgrass competition decreased perennial establishment.

October 2011. One "big" cheatgrass year built immense seed banks, limiting future seeding efforts, increased fire risk and made monitoring seedlings difficult. **notice plot stakes are not visible with tall cheatgrass*

May 2011. Seedlings that establish without cheatgrass competition grow rapidly to a 2-3 leaf "safe" stage.

Oct 2011. Early April 2011 Roundup® control of cheatgrass (right) vs. no control (left).

October 2012. Lower half of 40 acre plot dominated by lower succession Russian thistle

May 2013. Good seedling establishment after Roundup® cheatgrass control

May 2013. 10 acre exclosure

Antelope are often seen in fields surrounding research plots

Nov 1 2013. Failed Plant Material test seeding plot *notice Kochia stand back left field

May 2014. *"If you do nothing, you will get nothing. If you put a lot of hard work into a seeding project and do it wrong, you will fail. But, if you do everything right you have a chance!"*

Progressive Rancher. September 2013, Charlie Clements

May 2014. Greenstrip seeding