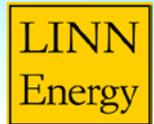


# Impacts of Drought and Recovery on Reclamation Success, Wamsutter Field



# Outline

- **Background Information**
- **Reclamation Challenges**
- **Climate Summary**
- **Effects of Recent Drought on Reclamation**

# Project

## 2 Primary Clients

- BP
- Linn

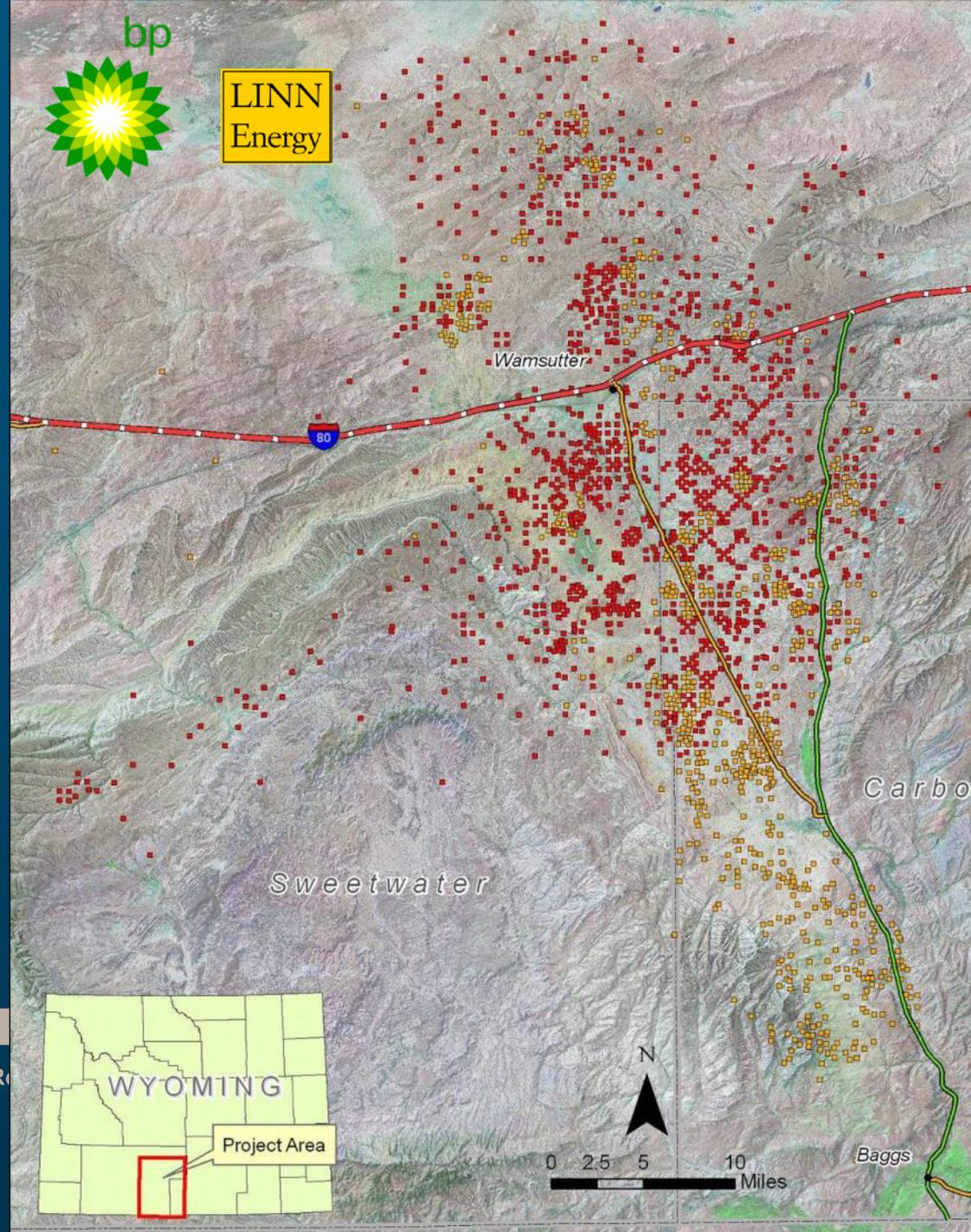
2000 Well pads

7 years of data

- Monitoring
- Observations, Photos
- Reclamation History
- Climate Records

**KC HARVEY**

Impacts of Drought and Reclamation  
Wamsutter Field



# Wamsutter Field Reclamation Challenges

## ➤ Limited Precipitation

- ✓ 7-9 inches/year
- ✓ Short growing season

## ➤ Limited Soils

- ✓ Thin, rocky, sandy, calcareous
- ✓ Saline (high salts) or Sodic (high sodium) soil chemistry

## ➤ Invasive Weeds

- ✓ Halogeton, Russian Thistle, others

## ➤ Grazing



# Limited Precipitation

- 7-9" annual precipitation zone (Wamsutter)
  - 2009 – 11.8"
  - 2010 – 11.1"
  - 2011 – 9.5"
  - 2012 – 5.9"
  - 2013 – 8.2"
  - 2014 – 7.6"

# Limited Soil Resources

## Soil Chemistry and Physical Properties

- ✓ 50% suitable soils
- ✓ 30% saline soils (High Total Salts Ca, Mg, Na)
- ✓ 20% sodic soils (High Na)
- ✓ High clay content
- ✓ Soils easily degraded, soil salvage critical

# Invasive Weeds

Halogeton

Russian Thistle

Canada Thistle

Whitetop

Houndstongue



ery on Re

# Grazing



# Correlation of Soil Chemistry and Plant Community



## Sagebrush, grass

✓ Suitable soils



## Grass, saltbush, sagebrush

✓ Slightly-Moderately Saline soils



## Saltbush, Grass

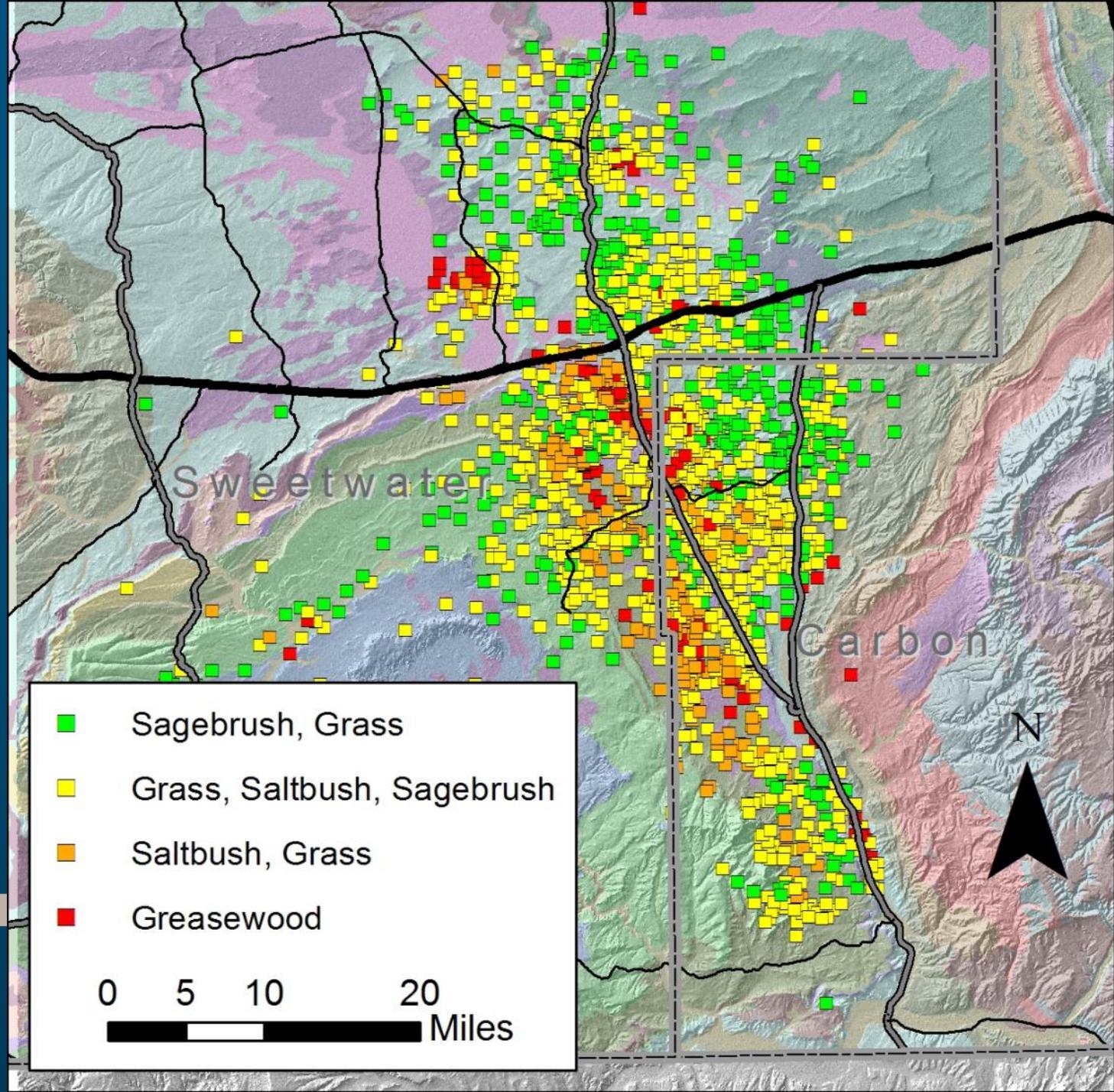
✓ Saline (or sodic) soils

## Greasewood

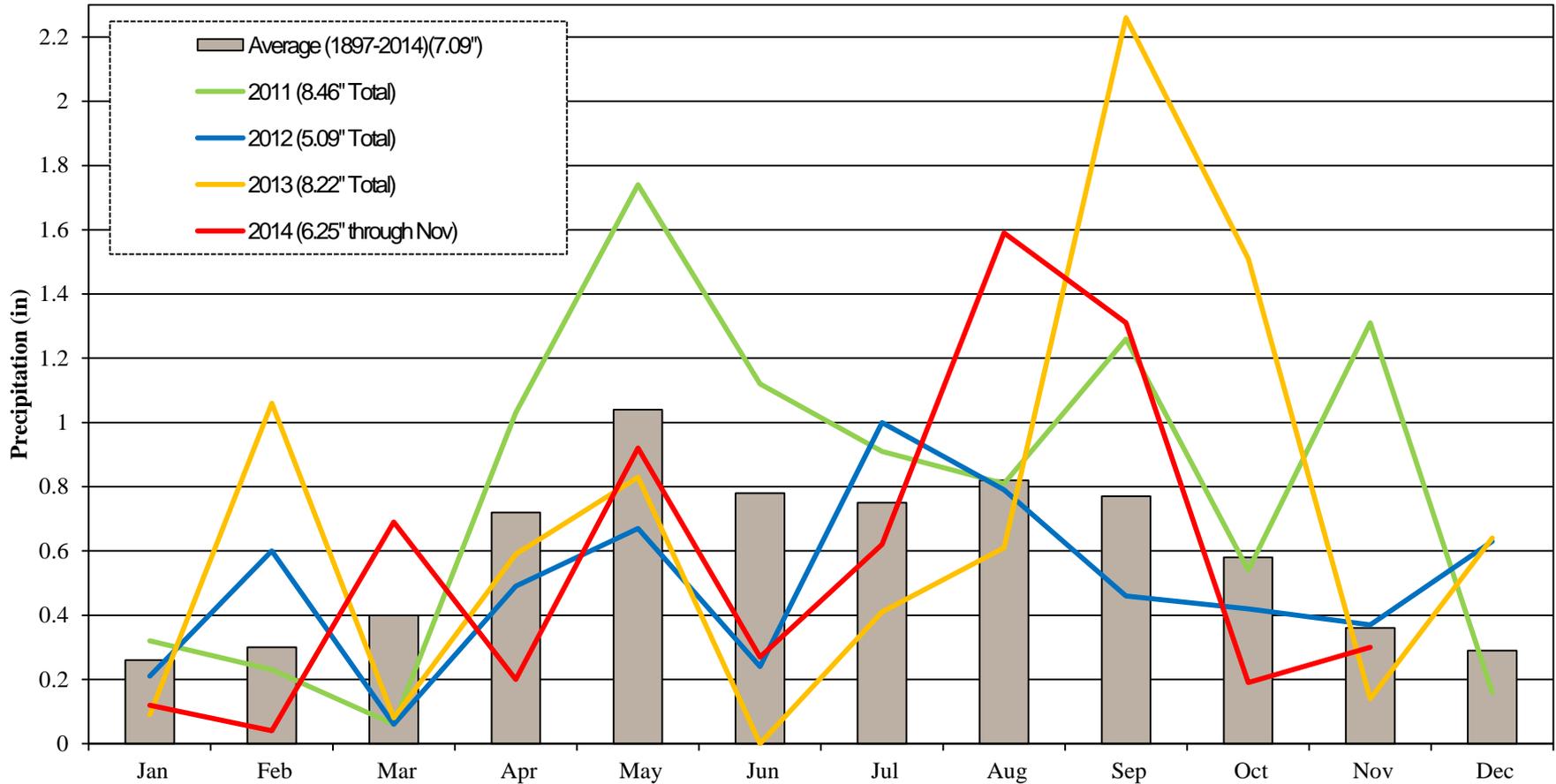
✓ Sodic, (or saline/sodic)

Suitability for  
Plant Growth

# Vegetation

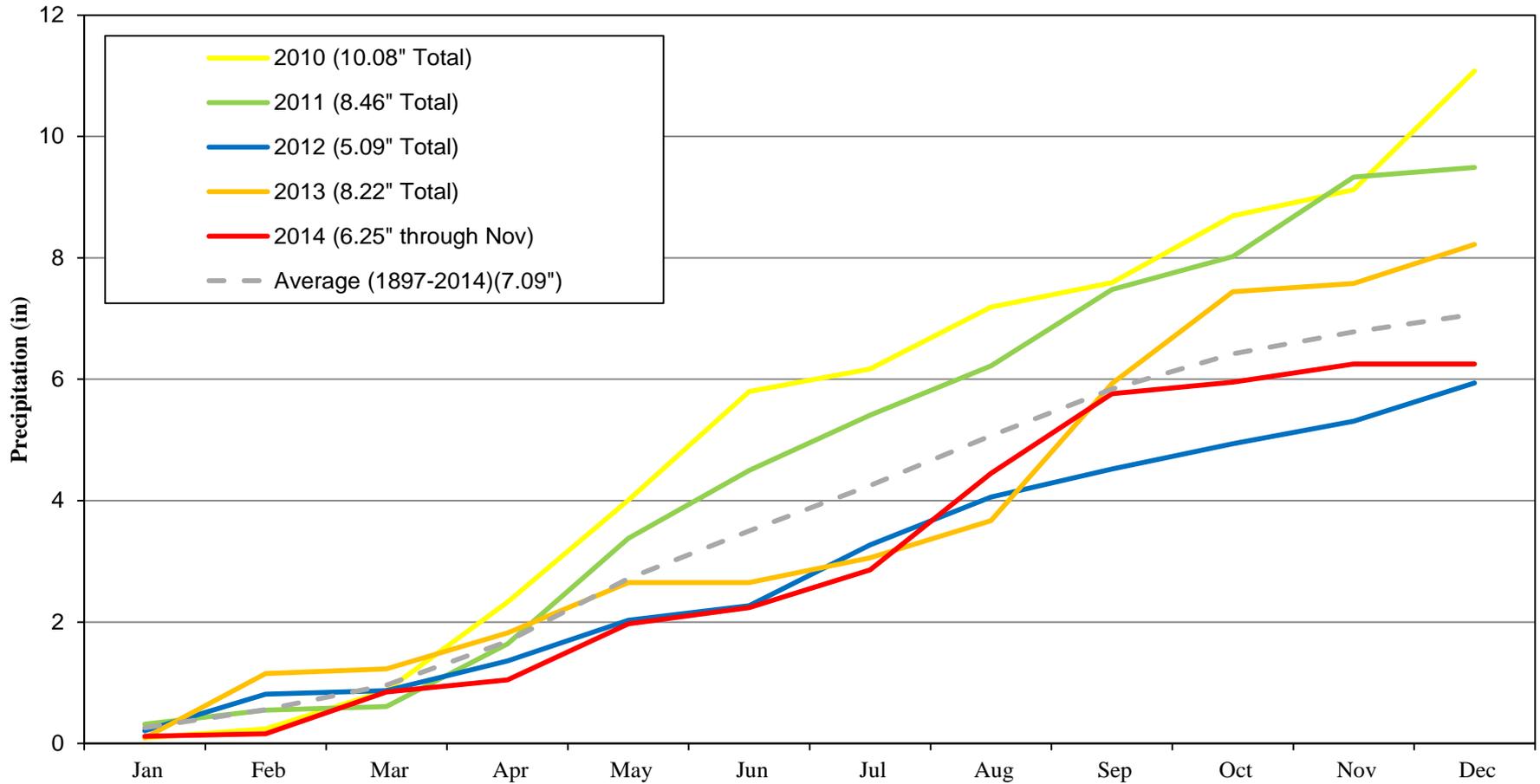


## Average Precipitation for Wamsutter, WY



\*Precipitation data is from the Western Regional Climate Center (WRCC)

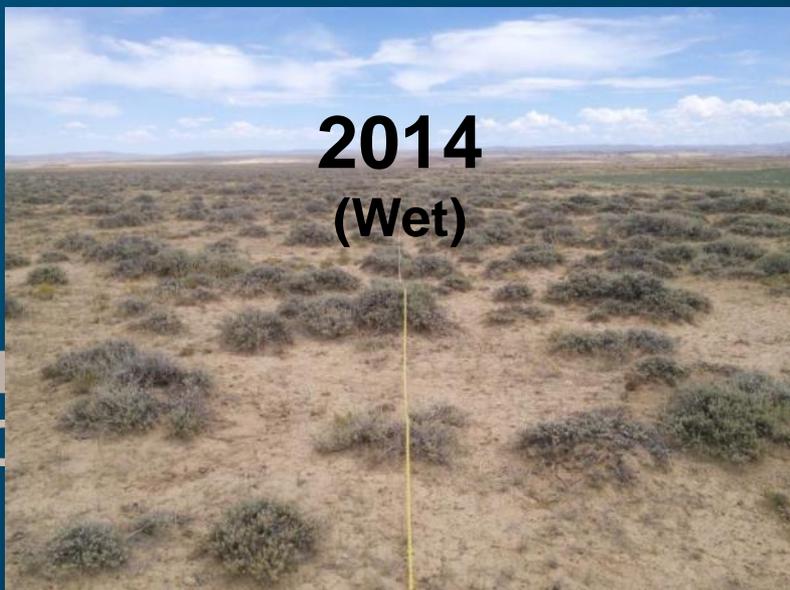
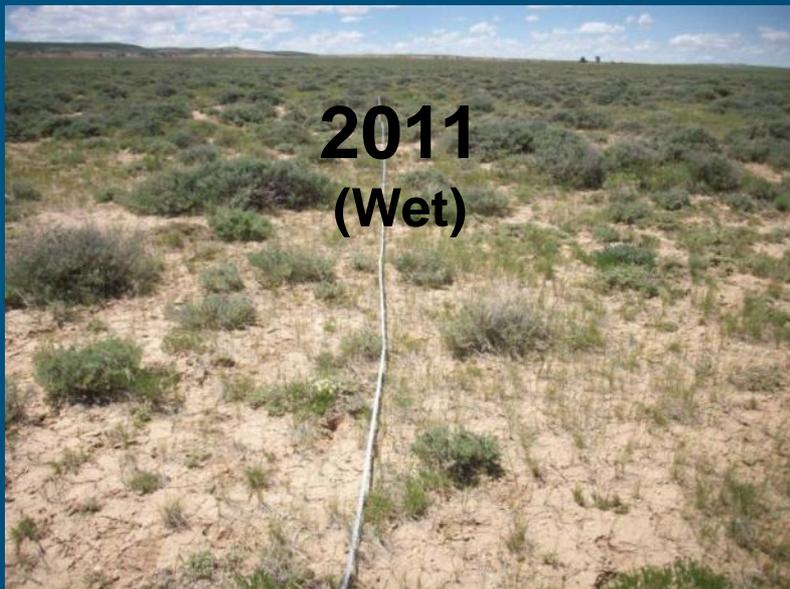
### Cumulative Precipitation for Wamsutter, WY (2010-2014)



# Native Range Drought Impacts

- ✓ Sagebrush/grass dominated community
  - Shrubs stable
  - Grass cover decreases
  - Forb cover decreases
  
- ✓ Greasewood/saltbush dominated community
  - Shrub abundance and cover decrease
  - Grass cover decreases
  - Forb cover decreases

# Native Sagebrush Community

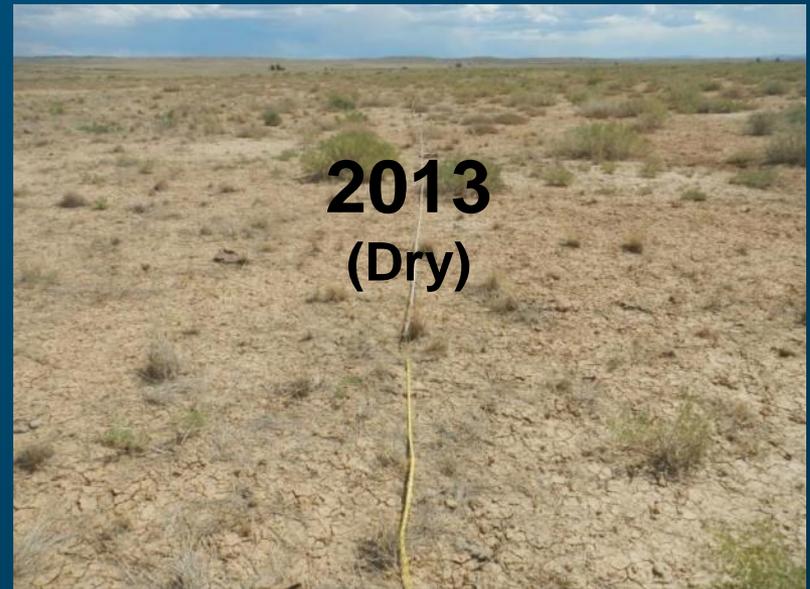


- ✓ Grass cover changes
- ✓ Forb Cover and Diversity changes
- ✓ Shrubs Stable

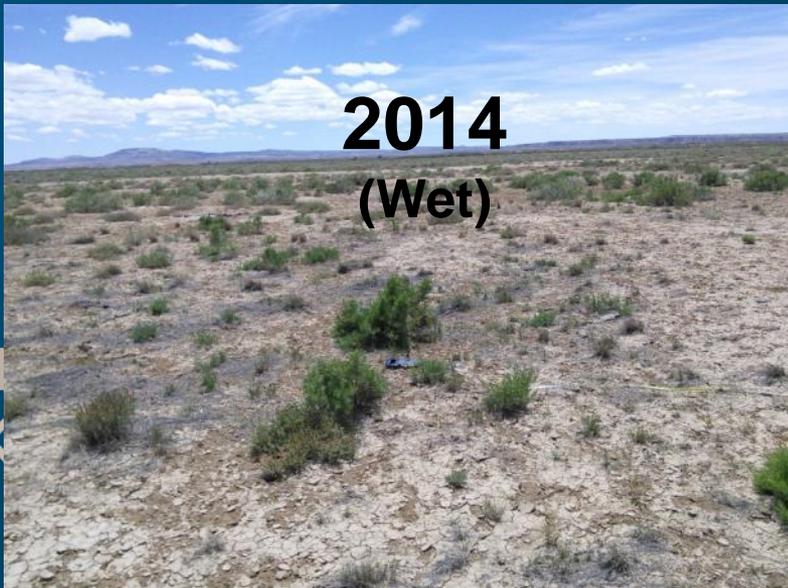
# Native Greasewood/Saltbush Community



**2011**  
**(Wet)**



**2013**  
**(Dry)**

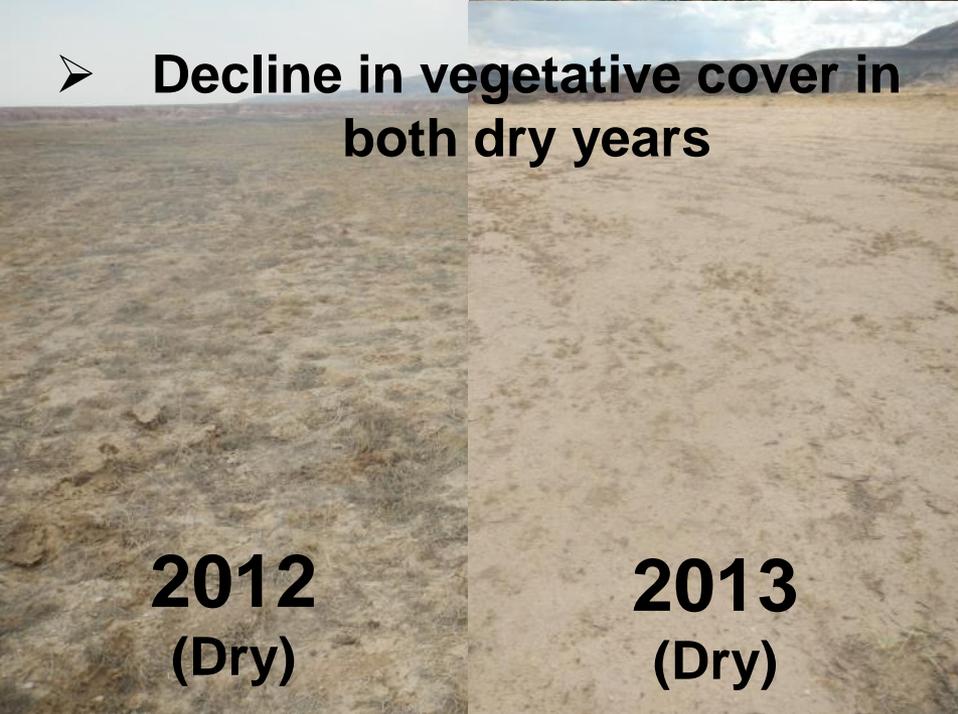
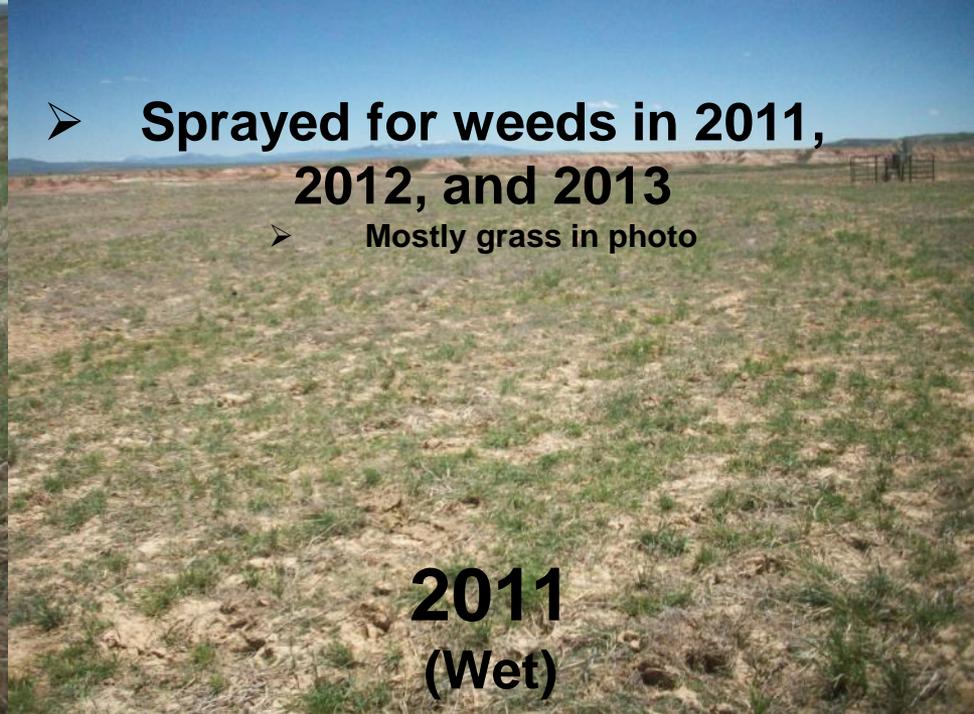


**2014**  
**(Wet)**

- ✓ Forb cover and duration  
*Lomatium* (Desert Biscuitroot)
- ✓ Grass cover
- ✓ Saltbush abundance

# Reclaimed Areas Drought Impacts

- ✓ Shrubs variable (saltbush, rabbitbrush, winterfat)
- ✓ Grass cover changes
- ✓ Forb cover changes



➤ **Sodic Soil**  
➤ **Amended, Seeded in 2008**  
➤ Mostly halogeton in photo

➤ **Sprayed for weeds in 2011, 2012, and 2013**  
➤ Mostly grass in photo

**2010**  
(Wet)

**2011**  
(Wet)

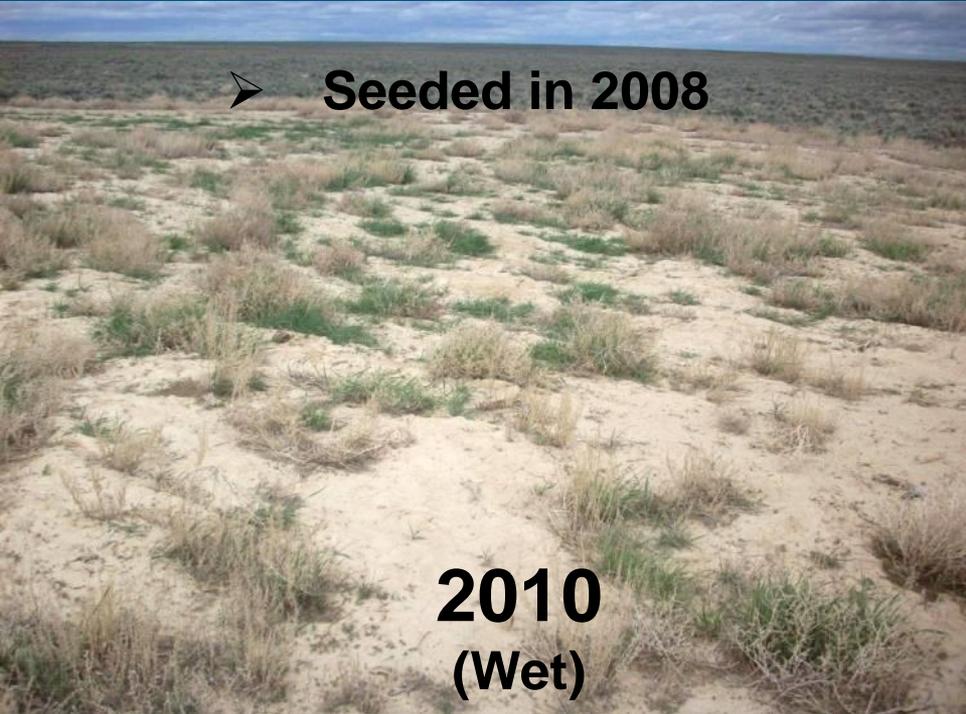
➤ **Decline in vegetative cover in both dry years**

➤ **Halogeton and Grass Return**

**2012**  
(Dry)

**2013**  
(Dry)

**2014**  
(Wet)



➤ Seeded in 2008

**2010**  
(Wet)



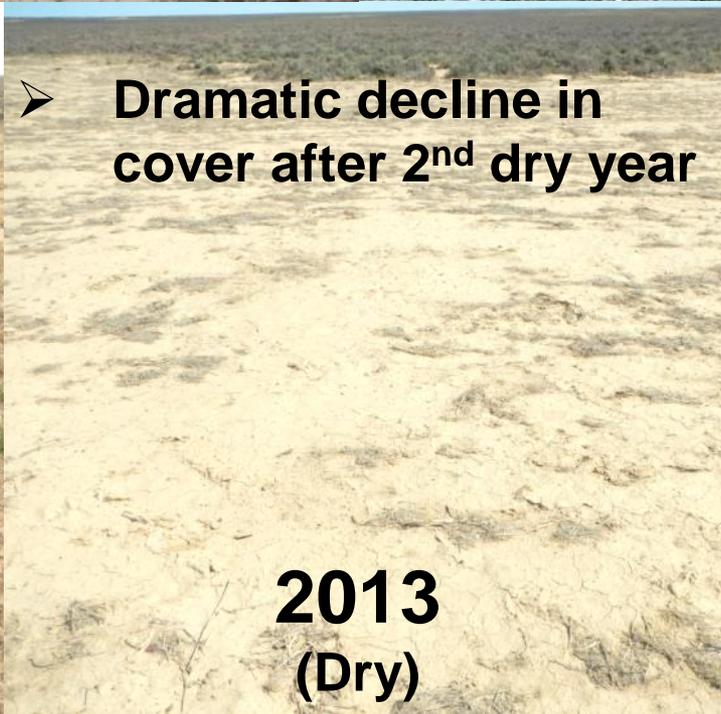
➤ Sprayed for weeds in 2011,  
2012

**2011**  
(Wet)



➤ Grass cover stable  
into first dry year

**2012**  
(Dry)



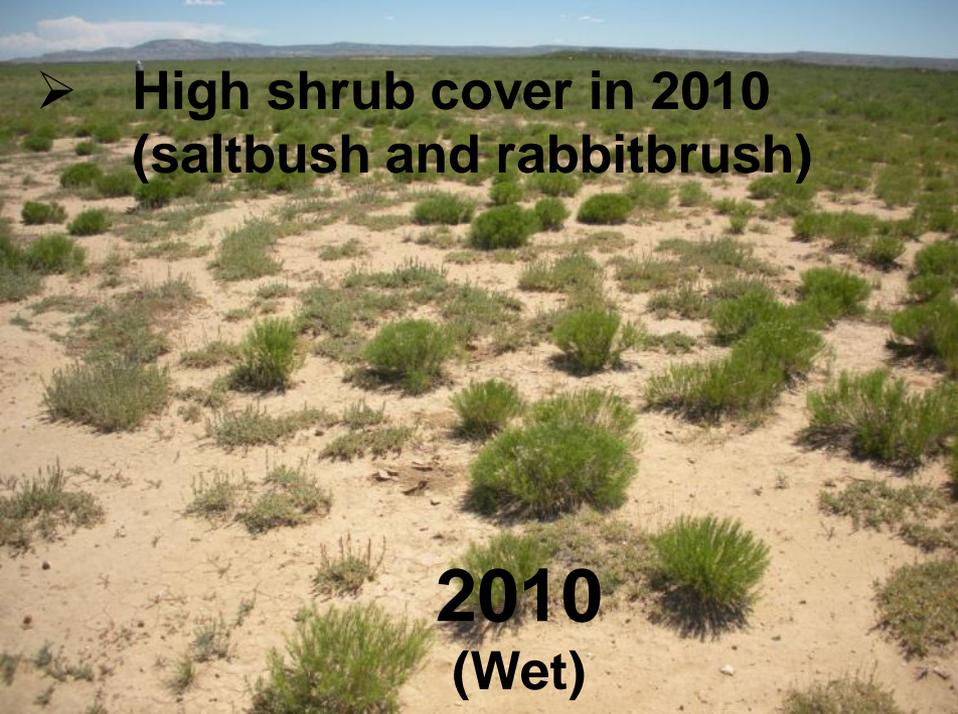
➤ Dramatic decline in  
cover after 2<sup>nd</sup> dry year

**2013**  
(Dry)



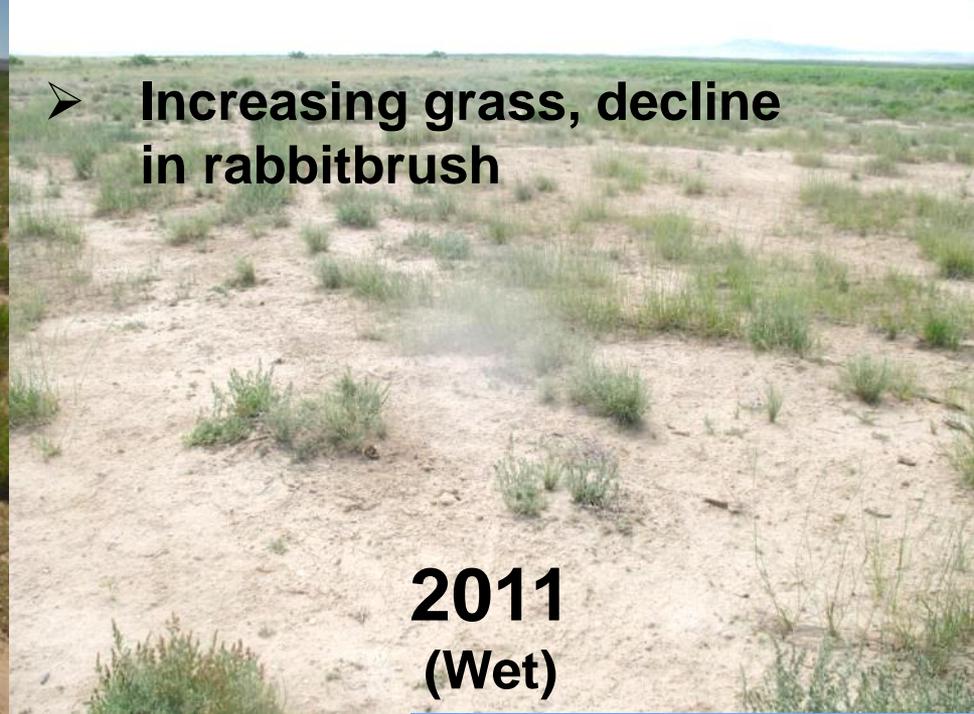
➤ Some recovery of  
grass cover

**2014**  
(Wet)



➤ **High shrub cover in 2010  
(saltbush and rabbitbrush)**

**2010  
(Wet)**



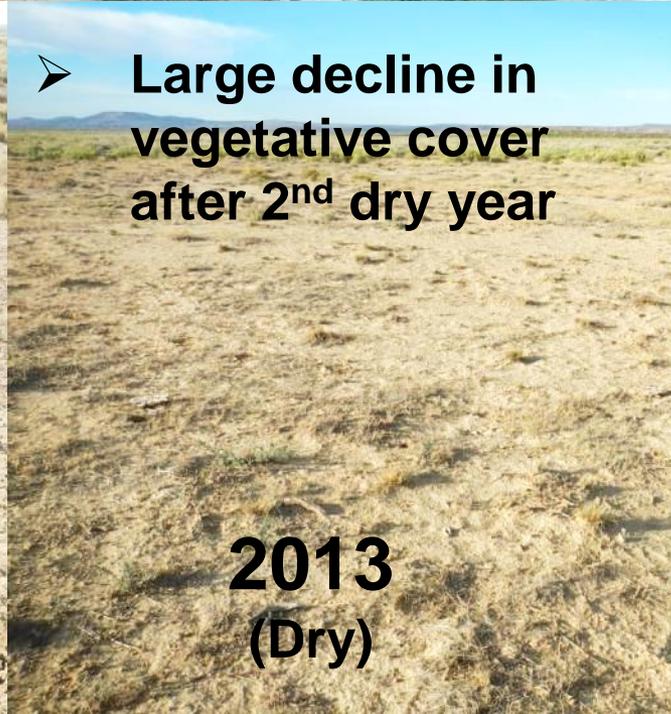
➤ **Increasing grass, decline  
in rabbitbrush**

**2011  
(Wet)**



➤ **Grasses continue  
to increase, shrubs  
disappear**

**2012  
(Dry)**



➤ **Large decline in  
vegetative cover  
after 2<sup>nd</sup> dry year**

**2013  
(Dry)**



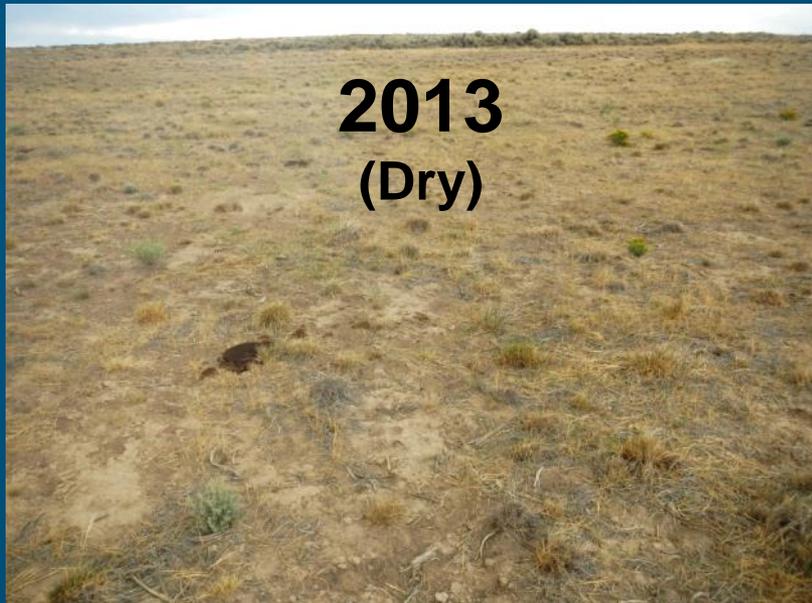
➤ **Some recovery  
in grass cover**

**2014  
(Wet)**

# 2013 to 2014 Recovery Examples



# Recovery Examples



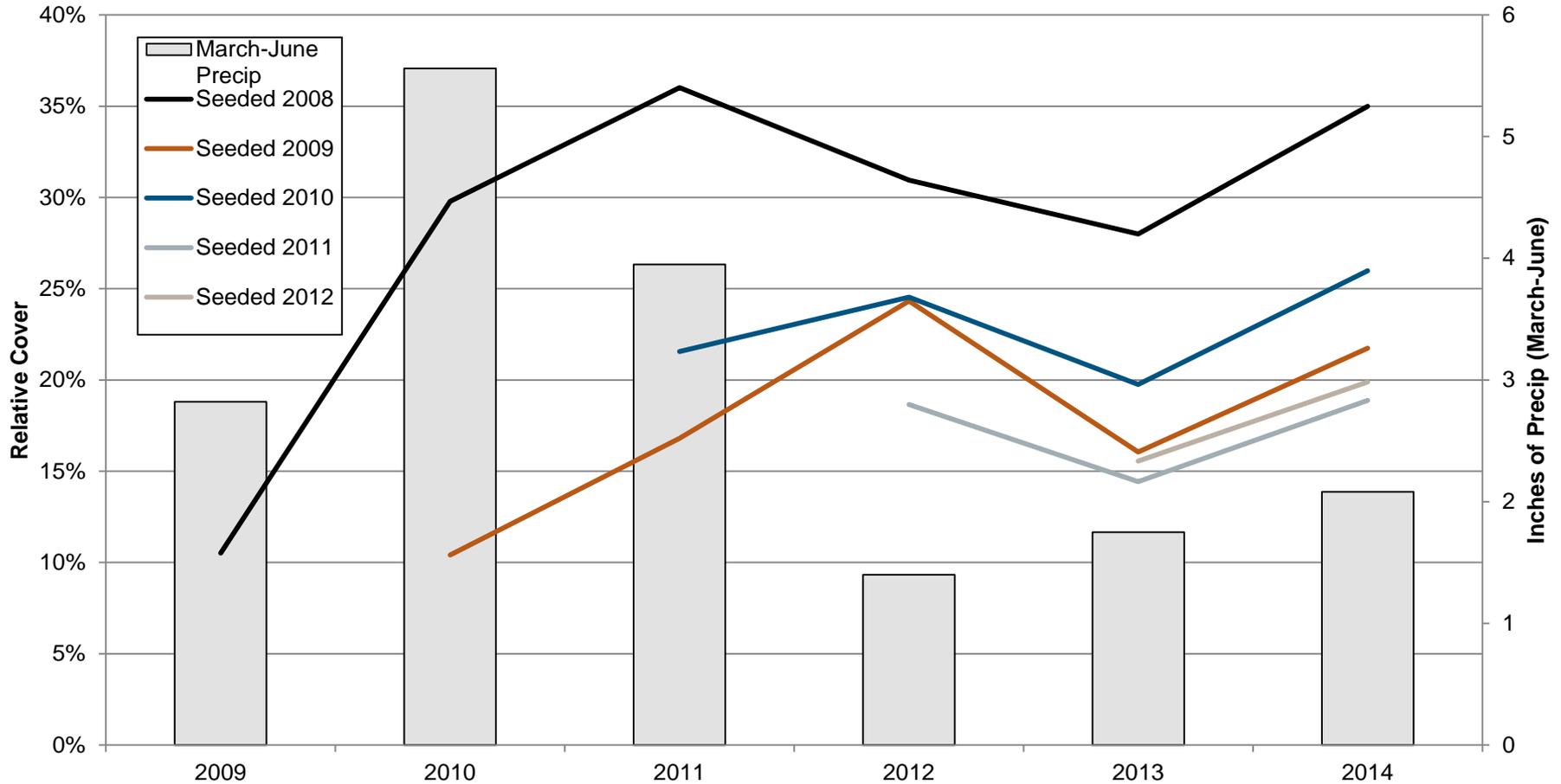
# Reclaimed Areas

- ✓ 834 locations
- ✓ Interim reclamation
- ✓ Various ownership
- ✓ No reclamation activities 2010-2014

	2010-2011	2011-2012	2012-2013	2013-2014
Average Change in Relative Cover	4.1%	2.8%	-5.2%	6.8%
Inches of Precip (March-June)	4.0"	1.4"	1.8"	2.1"

# Seeded Locations by Year

## Progress of Re-vegetation in Relationship to Precipitation



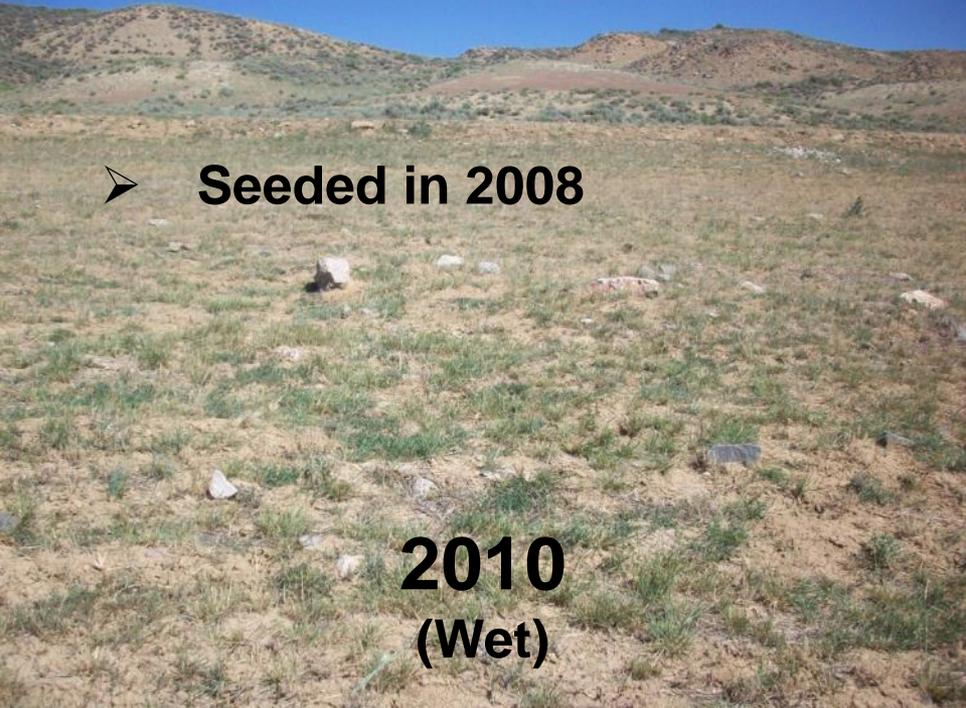
# Grazing and Fencing

- **Grazing patterns changes with precipitation**
  - In dry years, reclamation has more grass than the native range
  - Grazing animals utilize reclaimed areas more
- **Fencing stabilizes reclamation in drought**
  - Protects grass
  - Allows shrubs to establish



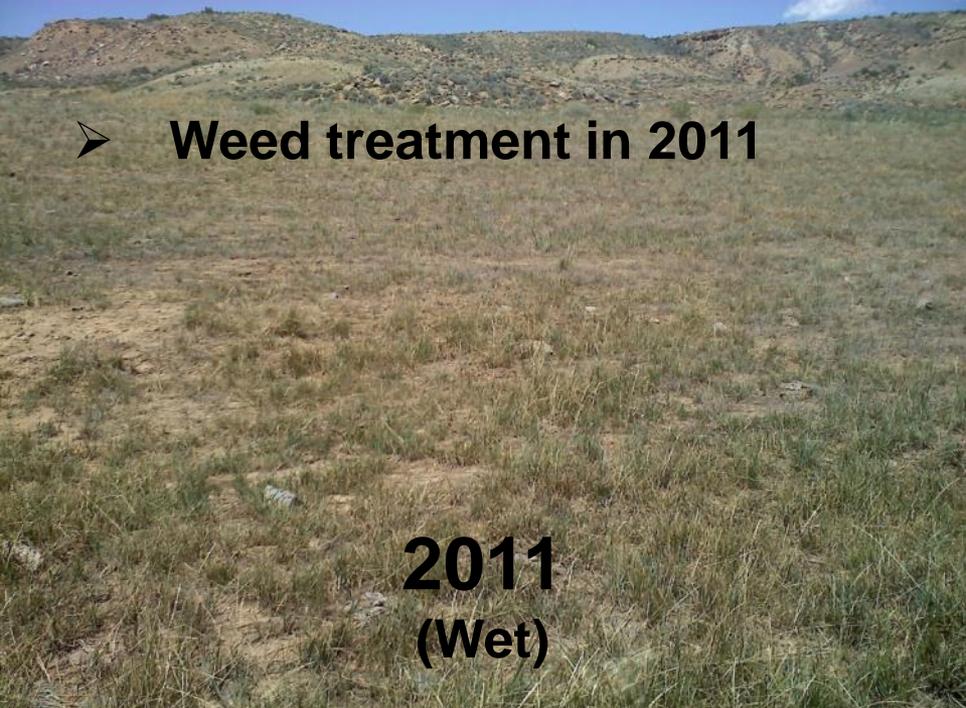
# Fenced Location Examples

- ✓ Grasses protected, cover reduced slightly
- ✓ Shrubs survive, can increase



➤ Seeded in 2008

**2010**  
(Wet)



➤ Weed treatment in 2011

**2011**  
(Wet)



➤ Fenced in Fall 2011

**2012**  
(Dry)



➤ Fencing stabilized reclamation into 2<sup>nd</sup> dry year

**2013 (and 2014)**



- **Seeded in 2009**
- All weeds in photo

**2010**  
(Wet)



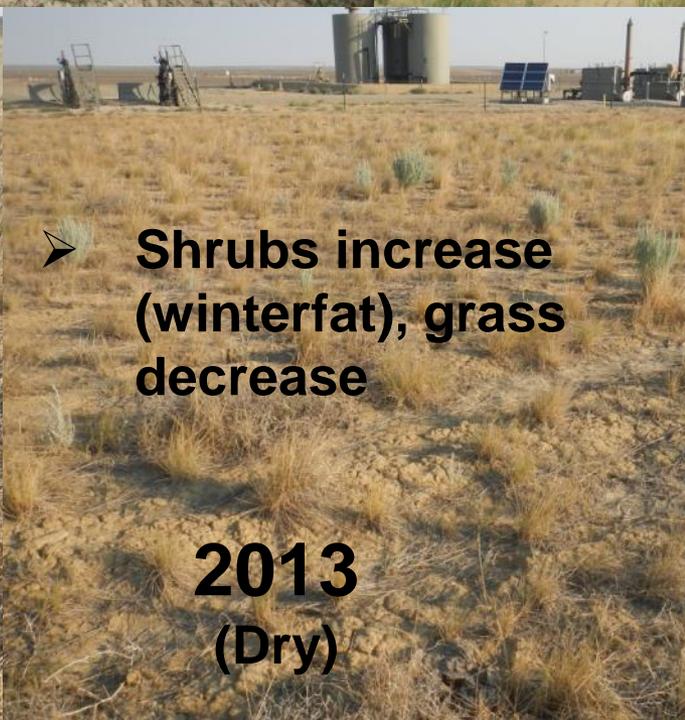
- **Fenced in Fall 2010**
- All grass in photo

**2011**  
(Wet)



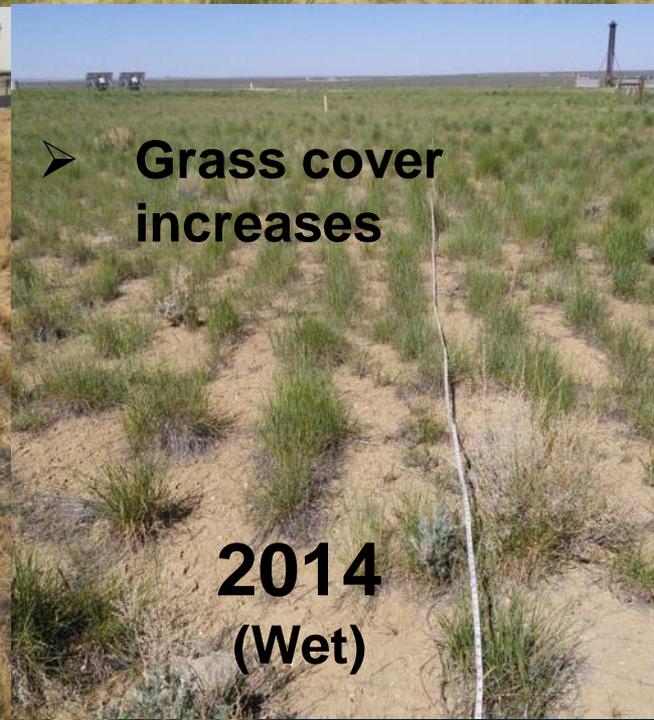
- **Vegetation stable into dry years**

**2012**  
(Dry)



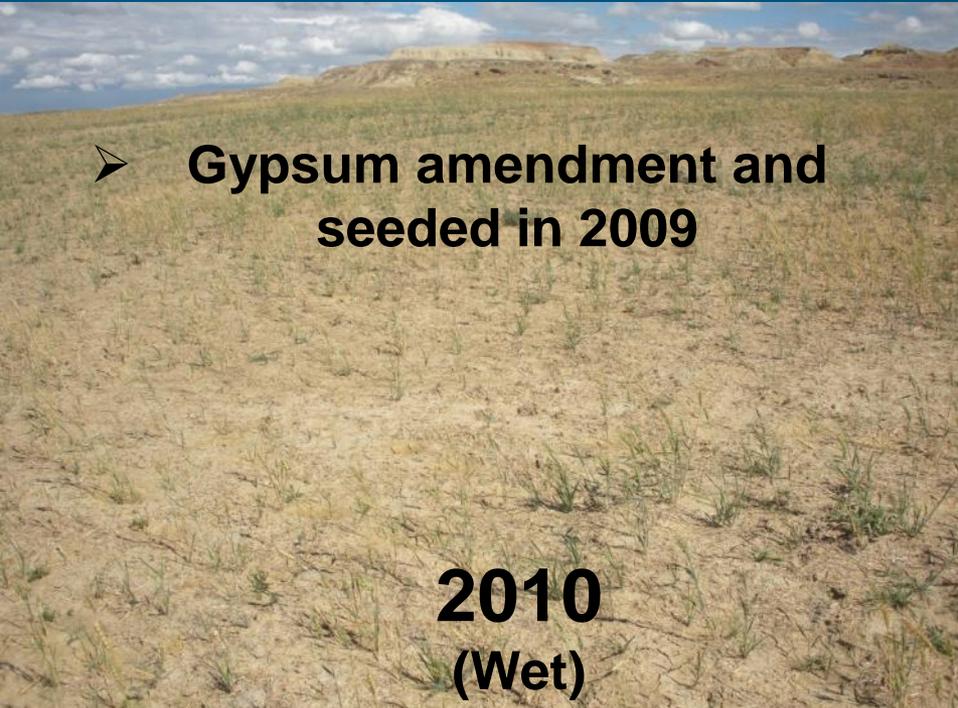
- **Shrubs increase (winterfat), grass decrease**

**2013**  
(Dry)



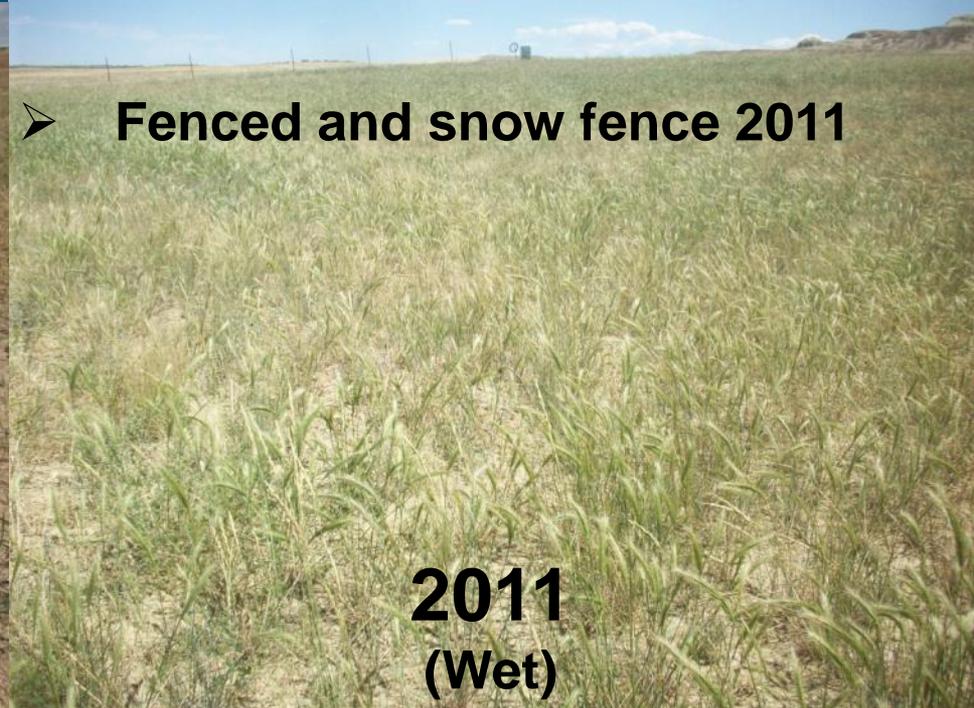
- **Grass cover increases**

**2014**  
(Wet)



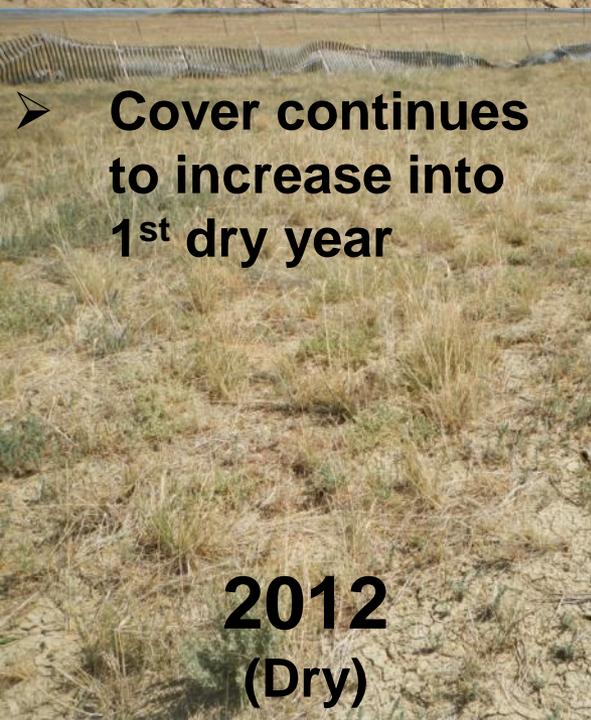
➤ **Gypsum amendment and seeded in 2009**

**2010**  
(Wet)



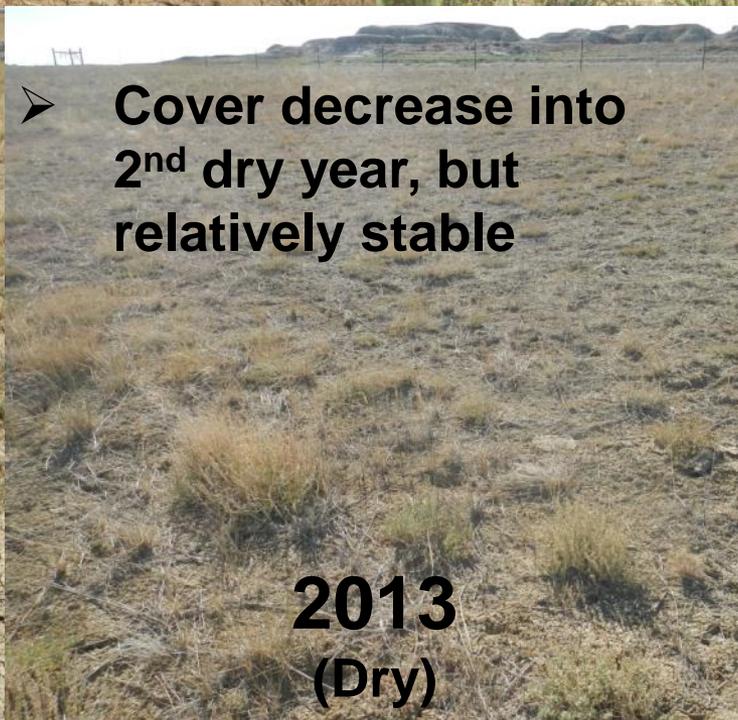
➤ **Fenced and snow fence 2011**

**2011**  
(Wet)



➤ **Cover continues to increase into 1<sup>st</sup> dry year**

**2012**  
(Dry)



➤ **Cover decrease into 2<sup>nd</sup> dry year, but relatively stable**

**2013**  
(Dry)

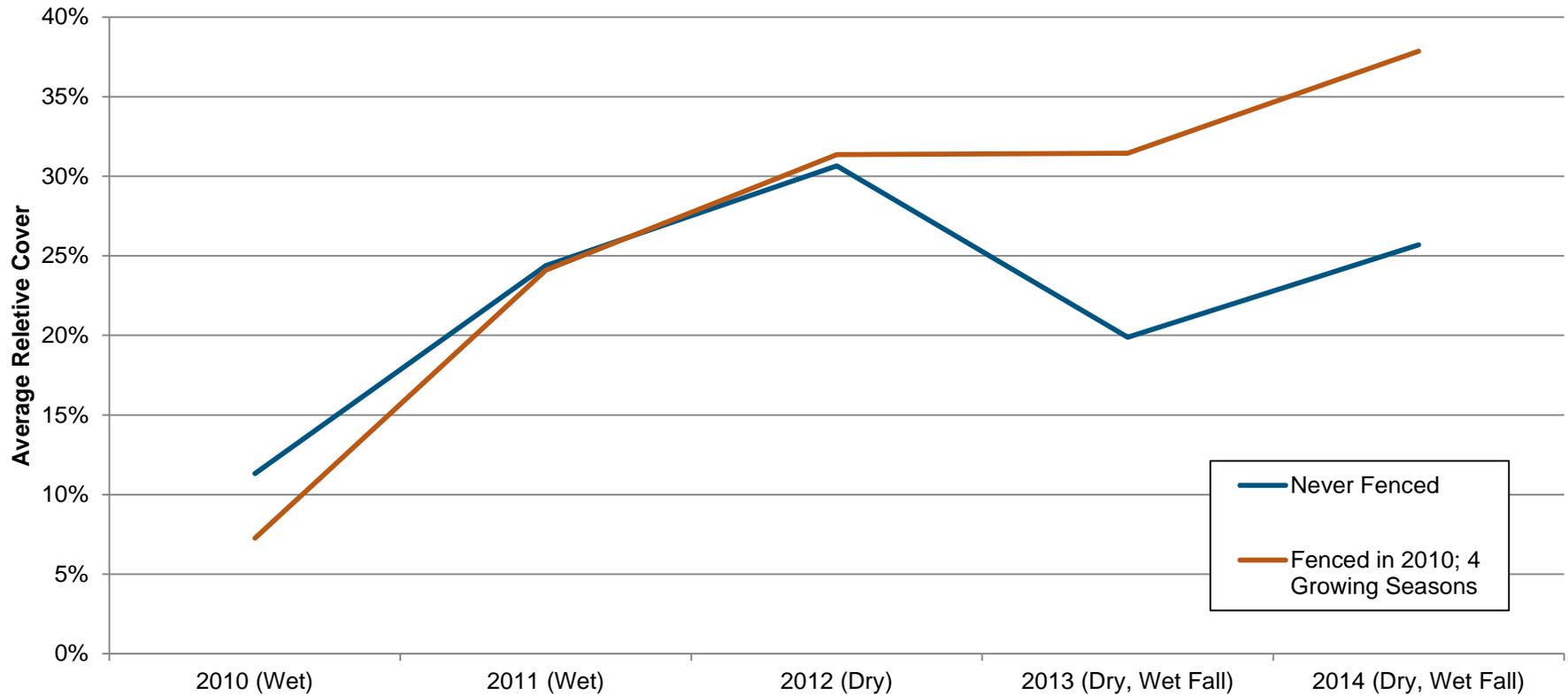


➤ **No cover increase in 2014**

**2014**  
(Dry)

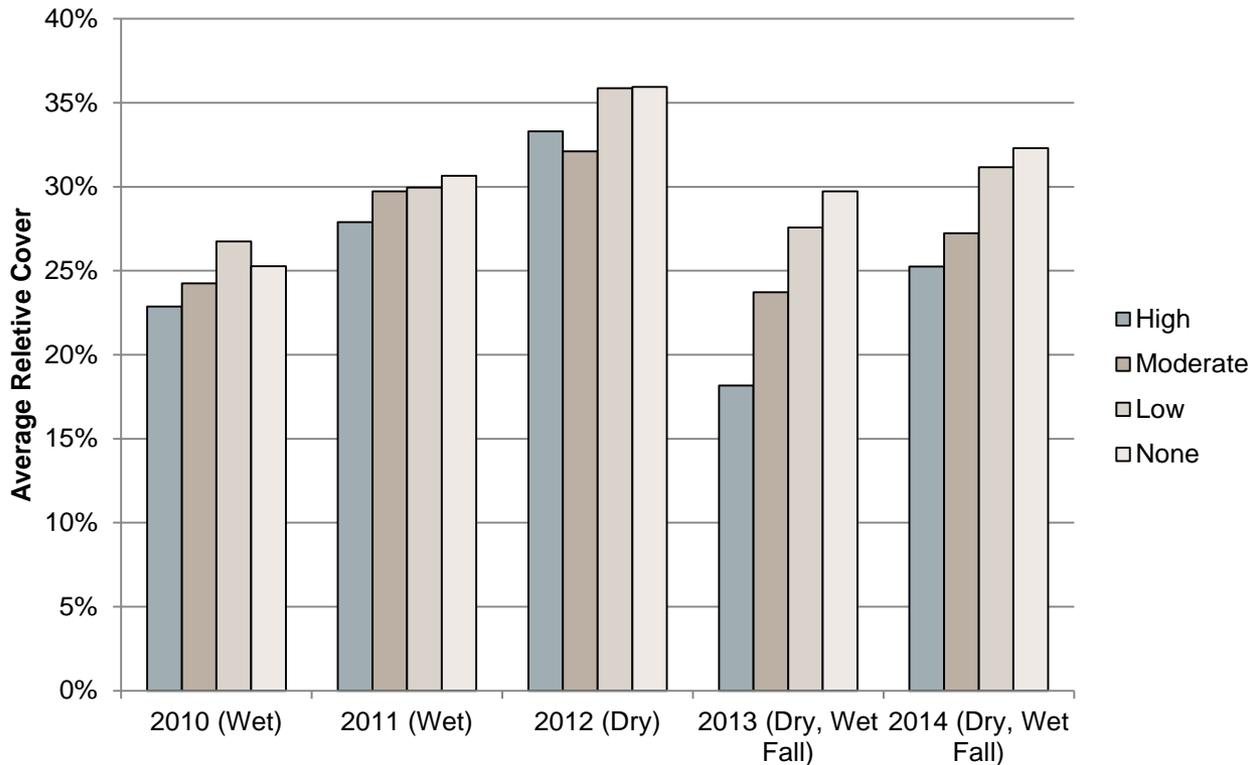
# Fencing

Average Relative Cover of Locations Seeded in 2009  
Fenced n=43, No Fence n=63



# Trends in Grazing Severity

## Average Relative Cover by Grazing Severity



## Number of locations by grazing severity category

Grazing Severity	2010	2011	2012	2013	2014
High/Moderate	90	67	121	140	33
Low/None	246	269	215	196	303

\*Data is from 336 locations with a seed date older than 2009 and no fence

# Conclusions

- ✓ Drought Impacts on reclamation challenges
  - Reduces soil leaching – salinity/sodicity impact increased
  - Low moisture during growing season – reduced germination and seedling survival
  - Weeds reduced – however, late precip can flush weeds
  - Grazing – forage reduced, reclaimed areas overgrazed
  - Fences protected vegetation through drought
- ✓ Persistent drought shows effects in the 2<sup>nd</sup> year
- ✓ Reclamation progress can reverse with 2 years of drought
- ✓ 2014 “Wet” year defined by September 2013 moisture despite low precip. in growing season