

# Use of GPS Treatment Data & ArcGIS tools: Evaluating Herbicide Treatment Effectiveness at a Reclaimed Coal Mine



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# Background: Southwestern Mine

- Permitted Acres: 25,000
- Disturbed Acres: 12,500
- Mine Operated 60 years with contemporaneous reclamation
- Mine is in Final Reclamation Phase
- SMCRA Authority: Federal/Indian & State Agencies

# Environment

- Elevation 6,300 to 8,000 Feet above MSL
- Annual Precipitation
  - Average 13 inches
  - Monsoon Rains - July through November
- Temperature: Typically varies 16°F to 87°F; rarely below 2°F or above 93°F
- Growing Season: Early May thru mid October
- Early Spring Bloom April 3rd



# Environment

- Wind Speed-Significant seasonal variation
  - Westerly Predominates
  - Calmest Day - August 15<sup>th</sup> avg 6.7 mph
  - Windiest Day - April 11<sup>th</sup> avg 12.1 mph
  - Wind Speed: 10/90 percentiles – 4 & 22 mph

# Noxious Weed Treatment

- 2010: Habitat Management began treatment operations.
- 2011: Extent of noxious weed infestations was recognized.
- 2012: A mine wide survey was conducted to map infestations to plan future treatments.

# Treatment Methods

- Backpack Sprayers
- 4X4 UTV Mounted Low Profile Tank Spray Rigs
  - Spring Loaded Hose Reels/Spray Guns
  - Broadcasters
- Chainsaws



# Noxious Weeds Treated

Canada thistle

Bull thistle

Musk thistle

Russian knapweed

Whitetop

Russian olive

Tamarisk

# Treatment Documentation

- Equipment used over duration of treatments
  1. Paper field maps & colored markers
  2. GPS units
  3. PDF Maps on tablets
  4. Dataloggers
- Treatments recorded by species, lat & long
- Daily herbicide use reports



# Noxious Weed Treatment

- 2013 through 2015
  - Weed treatment emphasized
  - Treatment data collected using maps and sharpies, and various GPS equipment
  - Rudimentary GIS database compiled

# Noxious Weed Treatment

- 2016 and 2017
  - Increased emphasis on infestation characterization
  - More detailed, accurate mapping
- 2017
  - Treatment data 2012 to present compiled into a geodatabase
  - GIS treatment database was analyzed
  - Findings submitted in the annual report

# GIS Treatment Database Analyses

- 2017 Client/regulatory agencies- Request herbicide treatment effectiveness evaluation
- 2016 and 2017 treatment locations compared
- Treatment density information used to evaluate effectiveness



# GIS Quantitative Grid Pattern Analysis

- Established 10,000 SF fishnets covering extent of the permits.
- GPS point data was spatially joined to fishnets.
- Empty fishnets discarded.

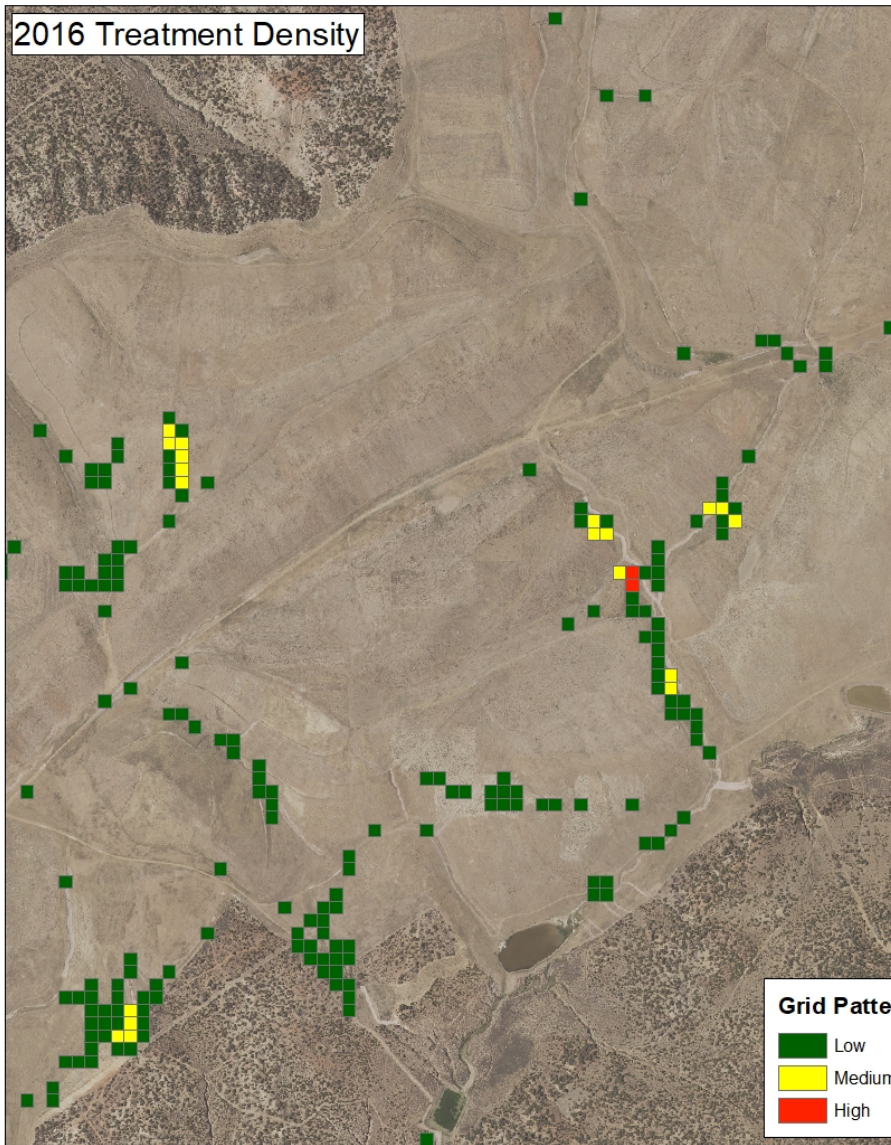
# GIS Quantitative Grid Pattern Analysis

- Number of treatments per grid was characterized
- ArcMap-Jenks Natural Breaks classification method used to create 3 grid density classes
  - Low
  - Medium
  - High

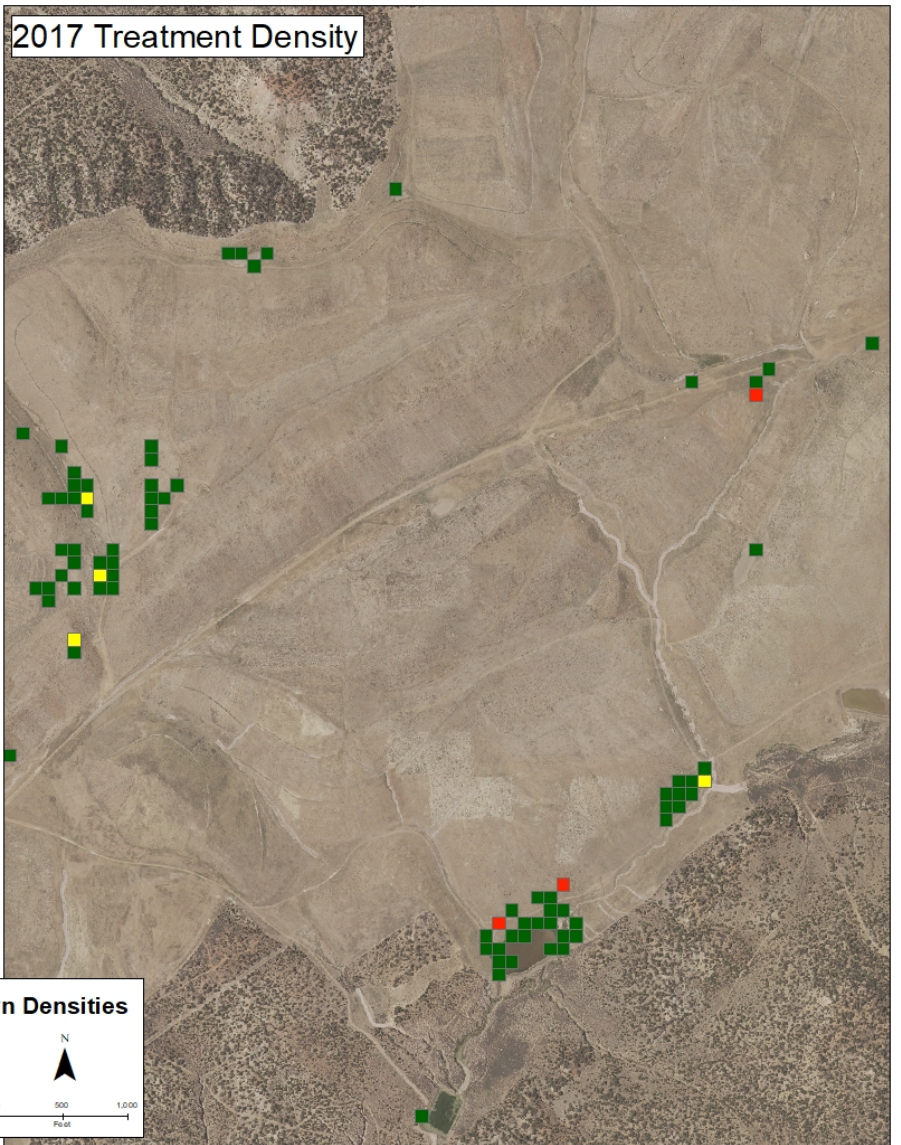


# GIS Grid Pattern Analysis

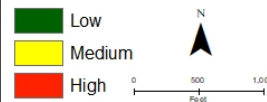
2016 Treatment Density



2017 Treatment Density



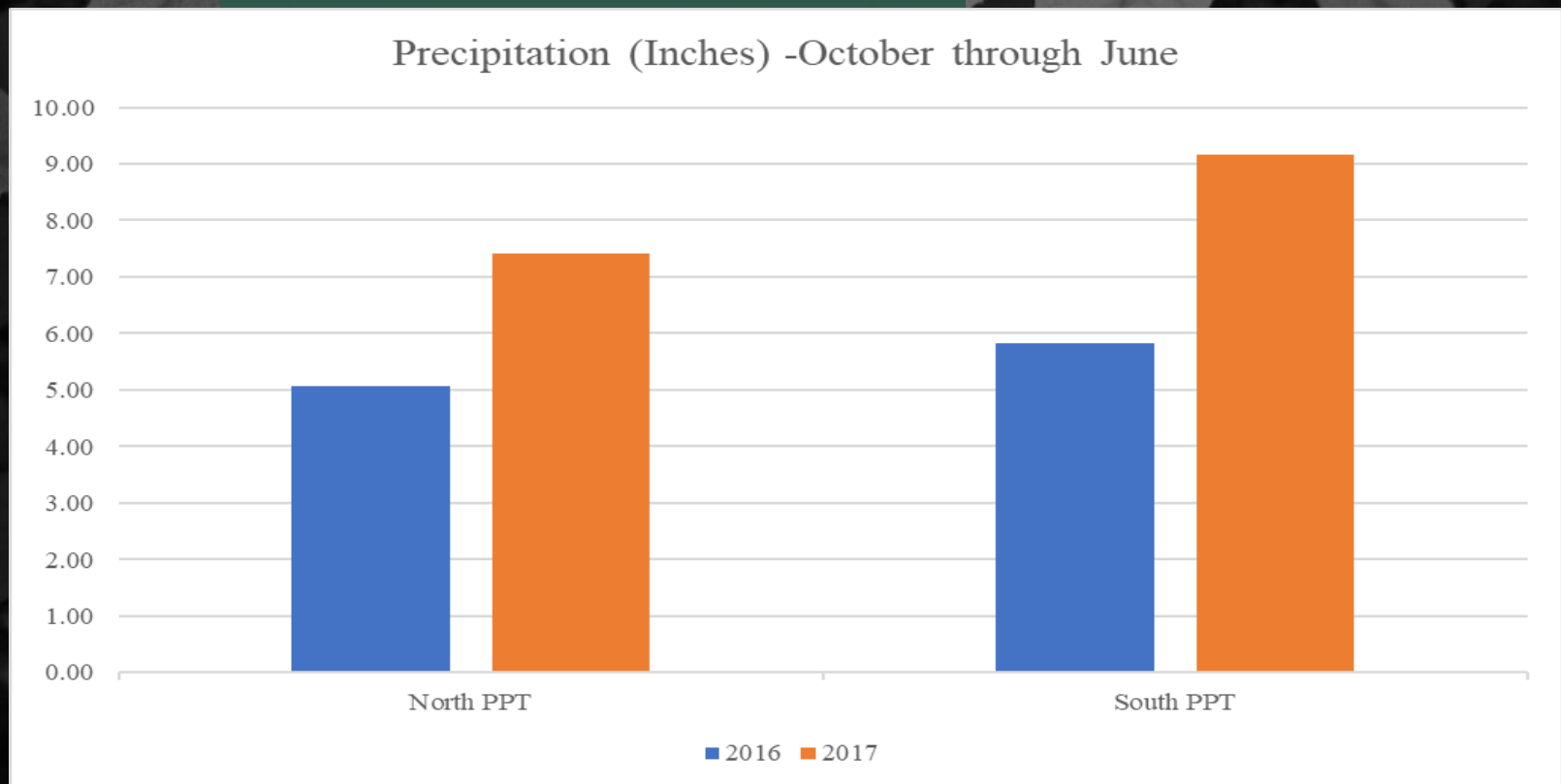
Grid Pattern Densities





# Herbicide Treatment Effectiveness

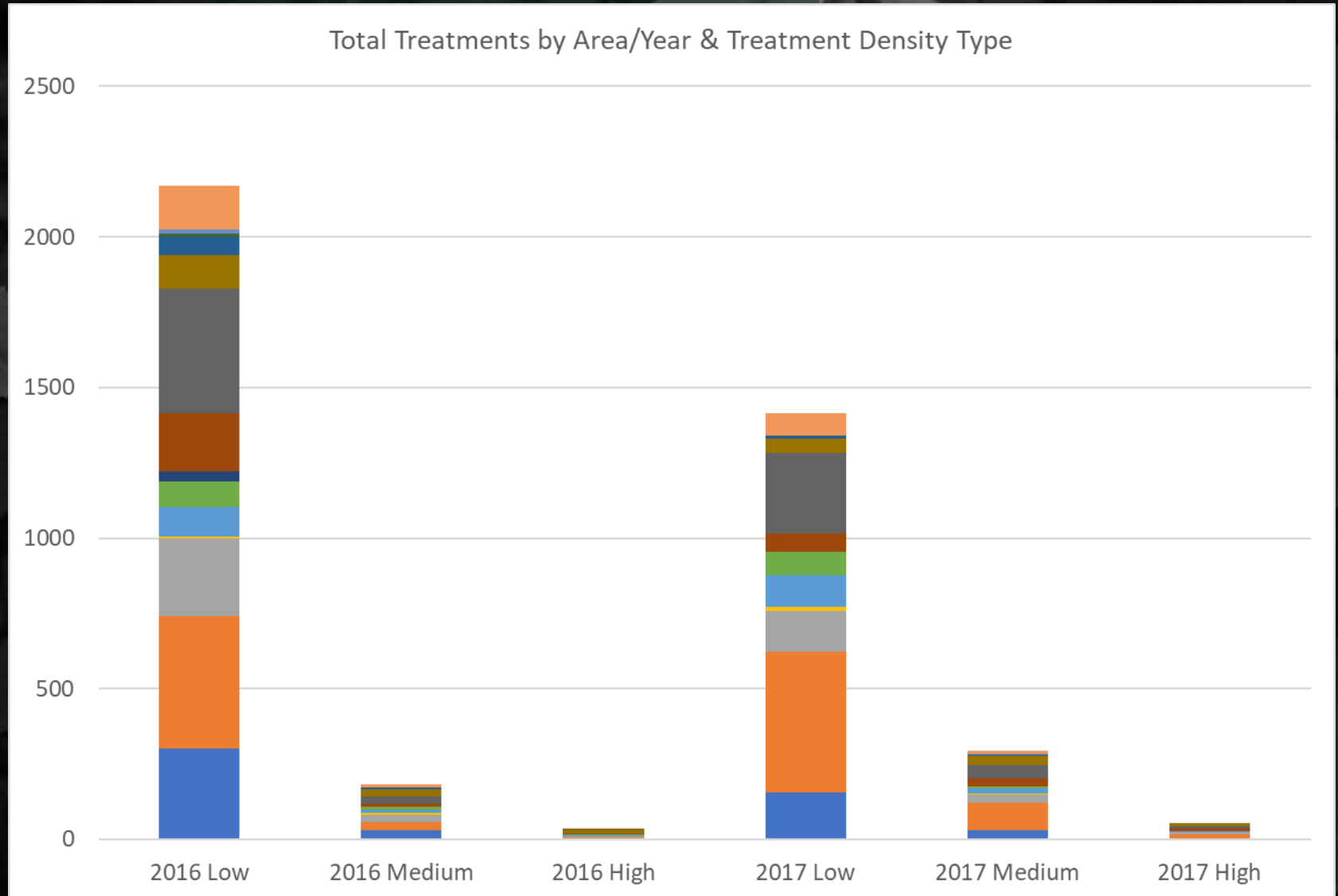
- Rain Gages: Year Around Collection
- Moisture Conditions Favored Increase in Cool Season Noxious Weed Populations



# Herbicide Treatment Effectiveness

Treatment Category:

Low Density=Significant Decrease; Medium Density=Moderate Increase; High Density=Slight Increase



# Summary

- Efficient data collection technologies are available to document treatments.
- Treatment variability may skew effectiveness evaluation results.
- Using treatment data assumes weed density and distribution are reasonably represented.
- GPS mapping and GIS tools can be used to evaluate treatment effectiveness trends.



# Summary

- Mapping illustrates trends in infestations.
- Effectiveness evaluations should take yearly environmental conditions into consideration.
- Infestation inventories can be performed periodically to document distributions.













# Questions?