Navajo Transitional Energy Company

# *Cheatgrass Monoculture Treatment in Coal Mine Reclamation*

*-Allen Wellborn, Spring Creek Mine; Decker, Mt.*

# Background

**Allen Wellborn**
**Environmental Engineer, Sr.**
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**Allen.Wellborn@navenergy.com**

**University of Wyoming:**
**B.S. Rangeland Ecology and Watershed Management**
**Minor: Reclamation and Restoration Ecology**

**Internships**

Spring Creek Mine- 2012

Experience:

**USFWS 2007-2010- Refuge Biological Field Technician Lead.**
Denio, Nv and Plush, Or.

**Spring Creek Mine 2012-2016- Environmental Engineer**
Decker, Mt

**Antelope/Cordero Coal Mines 2016-2019- Environmental Engineer**
Wright, Wy

**Genesis Alkali 2019-2021- Permitting and Compliance Lead**
Green River, Wy

**Spring Creek Mine 2021-current- Senior Environmental Engineer**

# About NTEC

- Navajo Transitional Energy Company (**NTEC**) is a Navajo Nation owned Limited Liability Company.
- Formed in 2013 to purchase Navajo Mine, New Mexico
- Hold a 7% share of the Four Corners Power Plant, New Mexico
- Helium Project within the Navajo Nation Land
- Invested in a Lithium Project in Wikieup, Az
- Alternative and Renewable Energy Projects (Primarily on the Navajo Nation)
- **NTEC** acquired Spring Creek Mine along with the other assets of Cloud Peak Energy on October 24th 2019

# NTEC Operations

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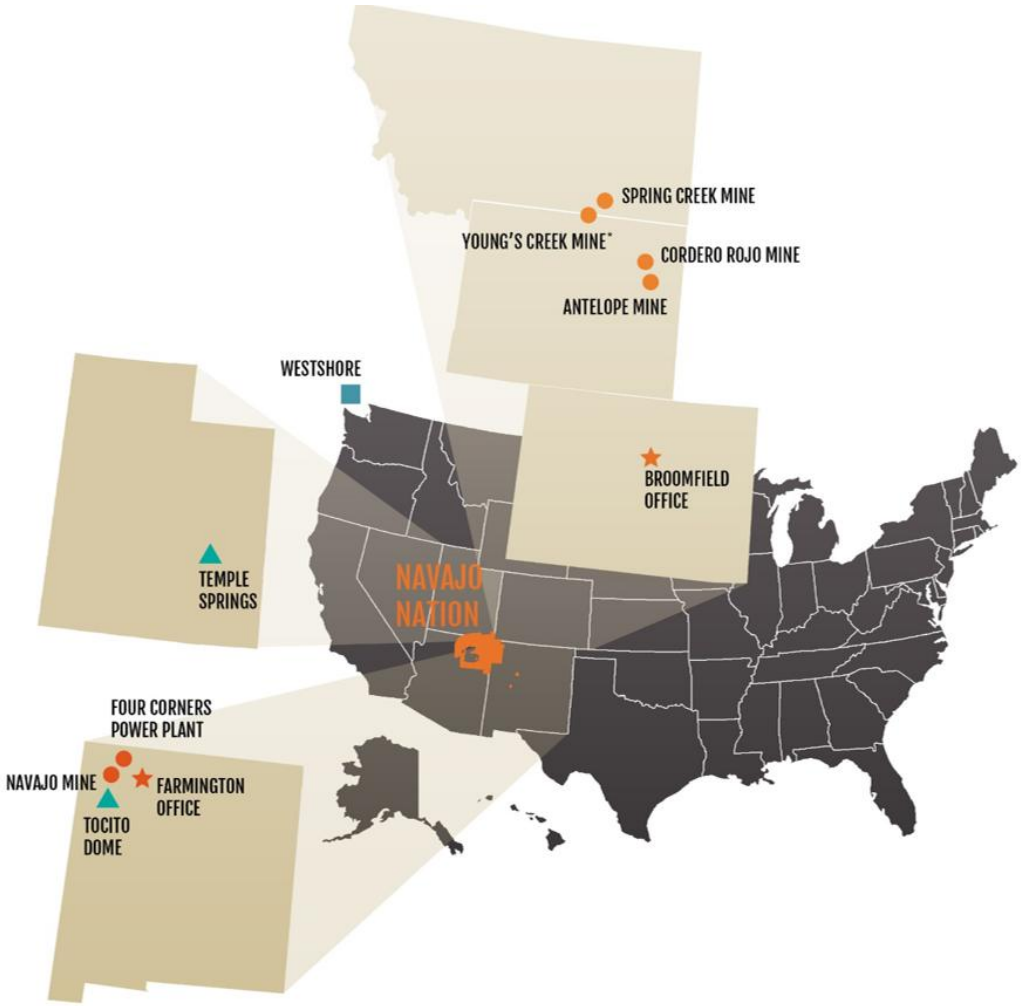
**2025 by the numbers:**

- **Approx. <u>1,318 employees</u> in Wyoming, Montana, Colorado and New Mexico**
- **3rd Largest U.S. Coal Producer**
- **Approx. <u>46.0 million tons</u> produced**
- **Approx. <u>2 percent</u> of U.S. Electricity Generation**
- **<u>4.3 million tons</u> Exported to Asia through British Columbia**



# Spring Creek At-A-Glance

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- **35 Miles North of Sheridan WY**
- **Started mining in 1980**
- ~485 millions tons shipped to date
- **261 employees(2026)**


- **10.4 million tons shipped in 2025**
- **5th largest coal mine in the U.S. in 2025**

- **Single 80’ Seam, Mined In Multiple Lifts**
- **Large Equipment:**
  2 draglines, 3 shovels, 17 trucks,
  8 dozers, 1 loader, 1 hydraulic excavator
- **Numerous Safety & Env. Awards**

# Recognized for Health, Safety & Environmental Performance

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**Interstate Mining Compact Commission (IMCC)**

New!

- 2026 – National Mine Safety & Health Training Award
- 2026 – National Mine Reclamation Award

**National Association of State Land Reclamationists – Outstanding Reclamation Award**

- 2018 – Impressive reclamation and innovative practices

**Office of Surface Mining (OSM) – National Excellence in Surface Mine Reclamation**

- 2017 – Enhanced reclamation success through diversity of topography, soil and vegetation
- 2009 – Voluntary plantings of rare mustard plant (woolly twinpod)
- 2005 – Reclamation of the South Fork stream channel

**Office of Surface Mining (OSM) – Good Neighbor Award**

- 2012 – Reclamation & mining education outreach, flood responses

**Mine Safety and Health Administration (MSHA) – Sentinel's of Safety**

- 2019 - 2017 – Sentinel's of Safety Runner-Up
- 2013 – Sentinel's of Safety Runner-Up
- 2011 – Sentinel's of Safety Runner-Up
- 2008 – Sentinel's of Safety Runner-Up
- 2005 – Sentinel's of Safety Runner-Up


**Rocky Mountain Mining Institute (RMMI)**

- 2013 – Safety Award
- 2006 – Safety Award

# Mine Layout

## ~2,000 Acres of Reclamation

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# What is Cheatgrass?

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Bromus *tectorum*

Downy Brome

**Cheatgrass Definition and Origin**

Cheatgrass is an invasive annual grass from Europe and Asia introduced to North America in the late 1800s.

**Life Cycle and Environmental Risk**

Cheatgrass germinates early before perennials, dries out by summer, creating a “carpet” of litter and seeds.

**Ecological Impact**

Cheatgrass reduces biodiversity and habitat quality by displacing native plants and promoting repeated fires.

**Wildlife and Habitat Decline**

Wildlife such as sage-grouse and mule deer suffer as cheatgrass invasion degrades native vegetation and habitat quality.

# Why Is Cheatgrass An Issue?

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1. Native Vegetation Establishment
   - High seed vigor outcompetes natives. Undesirable forage leaves litter that crowds out native plants

2. Soil Health
   - Cheatgrass is an indicator species- typically establishes in nutrient poor soils, especially when dry

3. Bond Release
   - Cheatgrass is not considered a native perennial species, and largely classified as an invasive species
   - Limits bond release for vegetation establishment criteria

Lets look into this in more depth….

# Native Vegetation Establishment

## Cheatgrass is an indicator species - Your soil isn't very good

### The Basics

- **When the soil has adequate available nutrients-** native plants can establish quickly and out compete annuals.
- **Little to no competition-** When cheatgrass establishes before perennials, it takes away the competitive space.
- Moisture- Perennial plants need early spring moisture. Without it, annuals establish.
- Scarification- Lack of mechanical or climatical scarification delays perennial forbs and shrubs.
- **Sunlight-** over growth of Cheatgrass shades the soil, prevent germination temperatures for annuals.

### Why does Cheatgrass limit these resources?

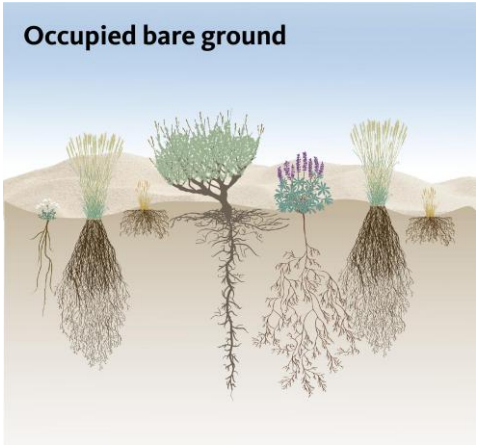
- Uptake of near surface nutrients.
- Spring and Fall Germination outcompetes perennial spring germination.
- Large seed volume crowds of the spikated perennial grasses.
- High vigor and biomass blocks out access to bare ground, light, and bio-available nutrients.

# Soil Health

## What do Native plants need to establish?

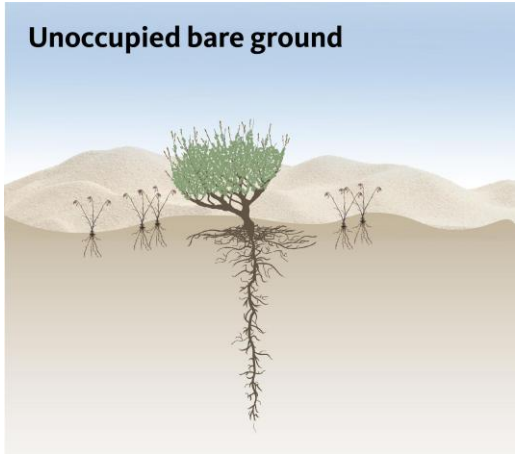
### The Basics

- Access to fertile soil- Cheatgrass has a shallow fibrous root structure, with quick germination
- Soil structure- Porosity and loamy content enable early germination
- Moisture- early spring moisture timing
- Scarification- mechanical from soil, or environmental- temperature
- Sunlight




### Why does Cheatgrass limit these resources?

- Cooler seed germination temperature leads to the first establishment
- Blocks soil structure at the surface for seed bed development
- Large seed volume sucks up available moisture at the planting surface
- High vigor blocks out access to bare ground, light, and bio-available nutrients



# How Does Brome Affect Bond Release?

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How does a Cheatgrass Problem Affect Bond Release?

In general there are 3 phases of Bond release through the OSM. The details of each phase can vary slightly from state to state:

- Phase 1: Final regrade and drainage design complete
- Phase 2: Desired vegetation established and trending toward post mine land use requirements
- Phase 3: Drainage basins complete, and vegetation meets post mine land use requirements

Cheatgrass directly affects the ability to achieve phase 2 by limiting desired vegetation

Before: Cheatgrass and Mustard

No Phase 2


After: Western Wheat, Green Needle, Russian Wild Rye, Greasewood, 4 wing, Silver sage

Phase 2 eligible

# SCM Infestation Status

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- Currently SCM has an estimated 300 acres of **severe infestation** spread across a current reclaimed acreage of 1,700.

- Of those 300 acres, approximately 90 acres are directly restricting Phase 2 bond release or have caused the phase 2 bond clock to reset 10 years.

# Challenges To Managing Downy Brome

1. Topography
    1. Access and steep slopes render traditional farming machinery useless.

2. Regulatory requirements
    1. Husbandry practices
        1. Bond Release
    2. Methods allowed by state rule

3. Equipment access
    1. No direct roads
    2. Mining infrastructure
    3. Existing reclamation
    4. Isolated infestation patches

4. Environmental Health and Safety Regulations
    1. Chemical Approval
    2. Safety and PPE
    3. Contractor Management
    4. Contractor approval

# Recognized Husbandry Practices

**Does Not Reset Bond**

Spraying
Mowing
Interseeding
Drag Harrow
Burning
Grazing

**Bond Reset- Soil Manipulation**

Tillage

Soil Ripping

Chemical Fallow

**Grey Area**

Chemical Fallow

Surface Scarifying

Now Selling: Cheatgrass Hay!

# How are we controlling it?

**Mechanical:**

- **Mowing/Raking/Baling**
- **Tilling under and re-seeding**
- **Surface Scarifying, litter removal, interseed**

**Chemical**

- **Herbicide/Graminicide**

**Natural**

- **Leave it be, pray western wheat outcompetes**
- **Selective soils**

# Mechanical Manipulation

Mechanical:

- Mowing/Raking/Baling
- Tilling under and re-seeding
- Surface Scarifying, litter removal, interseed



# Chemical Manipulation

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**Rejuvra- Pre- emergent**

**Active ingredient: Indaziflam**

**Control agent: inhibits cell biosynthesis, stopping seed germination**

- Spraying standing crop only in early summer.
- 7 oz/Acre

**Plateau- Pre and post emergence**

**Active ingredient: Imazapic**

**Control agent: enzyme inhibitor to stop BCAA production and DNA synthesis**

- Full tillage of soil followed by herbicide application in fall
- 8 oz per acre

**Volunteer- Post Emergent**

**Active ingredient: Clethodium**

**Control agent: enzyme inhibitor stops lipid production for new tissue growth.**

- Mow standing crop, rake and bale litter, then fall spray
- 8 oz per acre

# Natural Manipulation

**Example PAR2J**

Green Needle Grass Displacement


Western Wheatgrass Displacement


Factors:
Precipitation: the more the better, especially early
Temperature: cooler summers lend to better native production
Soil seed bank: if the topsoiled or direct hauled soil is “loaded”…good luck
Wildlife grazing: Heavy wildlife grazing of Native species helps cheatgrass.

# Success! Or is it?

Natural Manipulation- Time


**Greasewood skeletons**

**Western wheat**

**Basin wild rye**

**Cheatgrass**

Mowing and applying Impazapic


**What was once a cheatgrass monoculture…..**

**Leads to…….**

# Failures! What went wrong?

**Led to more bare ground!**

**Is still cheatgrass monoculture…..**

# Success!

**Mowing, Baling and interseeding…..**

**Led to a Western Wheat grass Edge effect pushing out the Brome**

# Failures! What went wrong?

**Deep Plowing, chemical fallow, cover crop and re seed……**

**Is still cheatgrass monoculture…..**

# What does Success Look Like

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Mowing, Baling litter, Spraying, Interseed

Western Wheat, Mustards, Green Needle, minor Brome recruitment.

# What does Success Look Like

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Mowing, Baling litter, Spraying, Interseed

Western Wheat, Slender Wheat,
Greasewood, 4 wing salt bush, silver sage.

Sagebrush monoculture from a bare area.

# Wrap-up

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**Reclamation is a value for NTEC**

**Legacy of reclaimed lands (point of pride with all involved)**

**Company is committed to reclaiming lands for a sustainable future use**

**There is not a one size Fix all method for treating *Bromus tectorum.***

# Questions?

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