

# Forestry Reclamation Approach Low Compaction Grading Step No 2.

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Forest Reclamation Advisory No. 3

July 2007

### LOW COMPACTION GRADING TO ENHANCE REFORESTATION SUCCESS ON COAL SURFACE MINES

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Forest Reclamation Advisory No. 4

July 2007

### LOOSENING COMPACTED SOILS ON MINED SITES

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Because successful surface-coal mining businesses must move earth materials efficiently, mining operations today use large and heavy equipment. Track dozers and haul trucks used for mining can weigh in excess of 100 tons each, while wheel loaders and loaded haul trucks often exceed 200 tons. It is becoming well known within the mining industry that successful reforestation of reclaimed sites requires loose and uncompacted surface materials, but some areas become compacted due to machinery operation, traffic, and storage that is necessary for the mining business to be successful.



**Figure 1.** Even when empty, haul trucks can weigh 50 - 100 tons or more; this weight exerts force where tires meet the land surface, causing severe compaction of mine soils. Loaders, dozers, and other heavy mining equipment also cause compaction that hinders tree growth when operated on surface soils.

Trees require deep, loose mine soils to survive and grow into healthy, productive forests. Such forests can support viable forest-products businesses, protect the watershed, store carbon, and serve as wildlife habitat. This advisory describes procedures that can be used to loosen soils that have become compacted by mining equipment in order to restore land capability for forests.

#### Avoiding Soil Compaction

The best way to deal with compaction on mine sites is to avoid compacting the soil in the first place. Uncompacted conditions suitable for trees can be created using techniques that cost less than traditional smooth-surface "tracked in" reclamation. Loose dumping of surface materials, combined with the minimum grading necessary to shape the land, creates loose soils and rough surfaces, increases

rainwater infiltration, and increases the survival and growth of trees. Throughout Appalachia, coal operators are finding these techniques to be a cost-effective successful method for establishing forests and achieving timely bond release when used with the Forestry Reclamation Approach (Burger and others 2005).

Coal operators can minimize equipment use on the final surface but there will often be areas that become compacted, generally the flatter areas and sites used for equipment storage. Many Appalachian and midwestern mine sites reclaimed under SMCRA have become compacted due to excessive equipment operation (Angel and others 2005). In order for such lands to support a forested postmining land use, soils must be loosened prior to reforestation.

#### What Can Be Done to Loosen Compacted Soil?

Flipping of the soil with a ripper blade or a deep plow attached to a dozer can alleviate most soil compaction effects on mine sites (Figure 2).

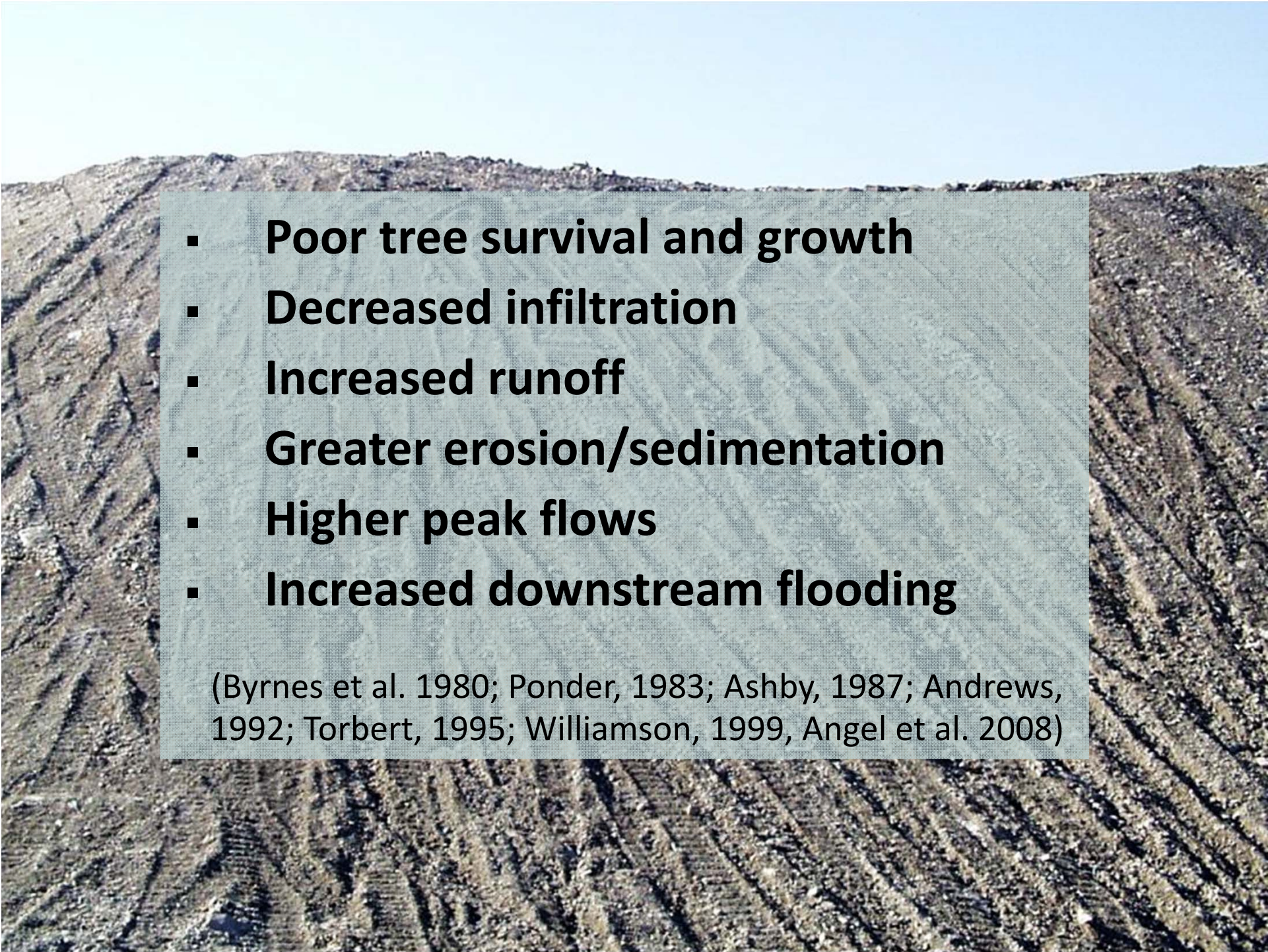


**Figure 2.** A dozer is ripping to loosen soils and produce soil conditions favorable to successful reforestation in a former roadway.

Subsurface ripping was first used for reclamation on prime farmlands disturbed by mining in the Midwest. In years following SMCRA's passage, rubber-tired equipment was often used to replace the subsoil and topsoil on prime farmland sites. Such practices compacted soils and created lands that could not produce the required crop yields.

## FRA Advisory No. 3: Low Compaction Grading on Surface Mines

## FRA Advisory No. 4: Loosening Compacted Soils on Surface Mines

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- **Poor tree survival and growth**
  - **Decreased infiltration**
  - **Increased runoff**
  - **Greater erosion/sedimentation**
  - **Higher peak flows**
  - **Increased downstream flooding**

(Byrnes et al. 1980; Ponder, 1983; Ashby, 1987; Andrews, 1992; Torbert, 1995; Williamson, 1999, Angel et al. 2008)

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# **Forestry Reclamation Approach**

## **Step 2**

**Loosely grade the topsoil or topsoil substitutes established in step 1 to create a non-compacted growth medium**

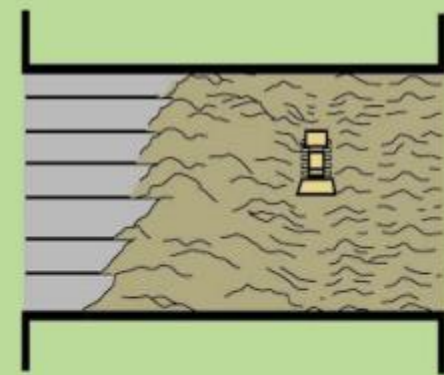




ARRI CFoldBroDiag1F.eps

Illustrations not to scale.

Recommend no more than two passes with equipment to remove excessively large rocks and shape to final backfill configuration.



ARRI CFoldBroDiag3F.eps

(Forest Reclamation Advisory No. 3, 2007)

Illustrations not to scale.



# Loosening Compacted Mine Soils

The Effects of Scraper Pans on Mine Soil Compaction and Tree Growth at an East Texas Lignite Surface Mine



# Gulf States Region

## Luminant Mining Co.

- Research Location
  - Oak Hill Mine, Henderson TX
- Area Mining Method
  - Dragline Operation
- Reclamation Approach
  - Oxidized Material Haulback





# Oxidized Material Haulback Methodologies

Truck-Shovel Combination



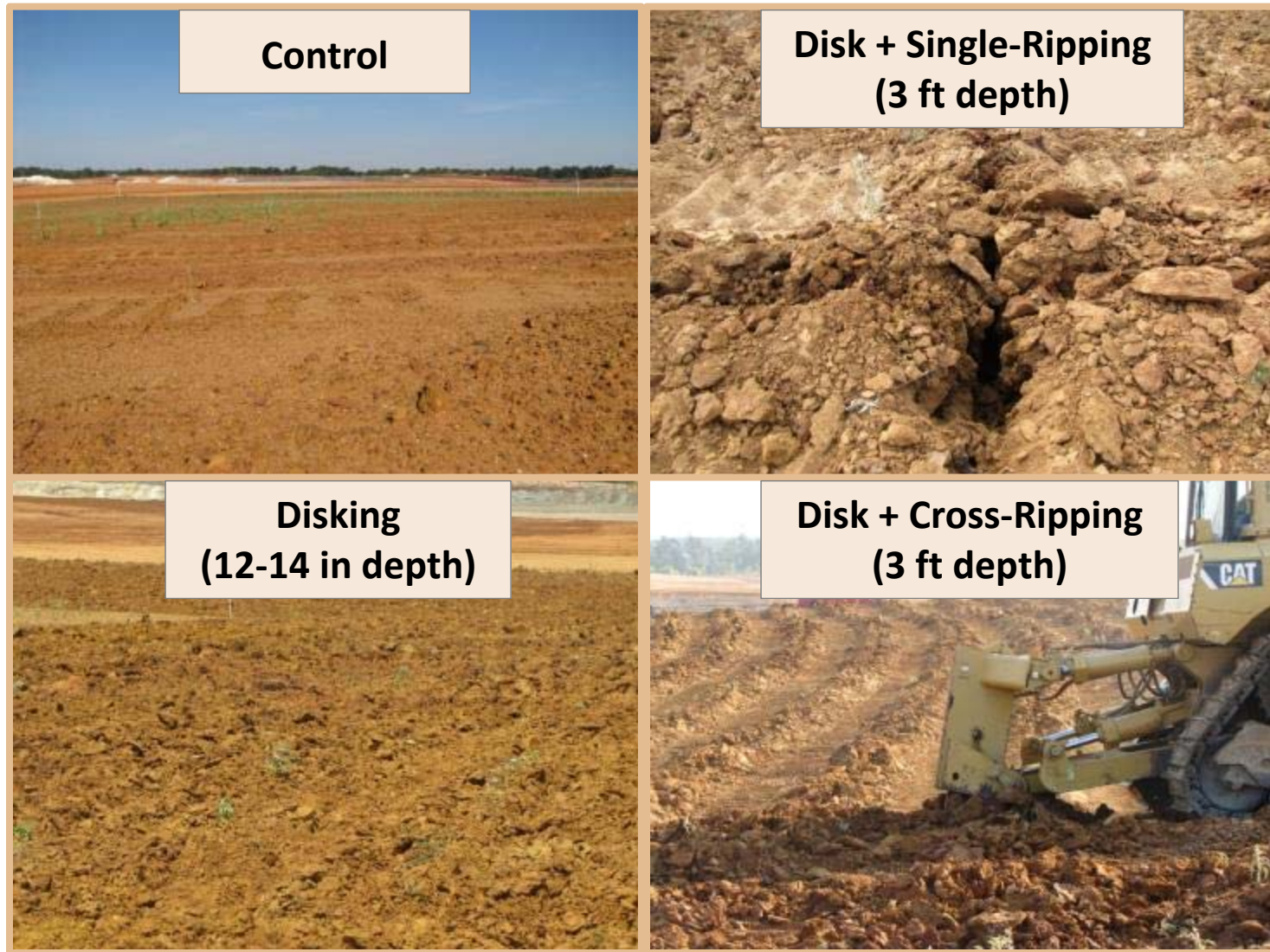
Tractor Pulled Scraper Pans



# Gulf States Region: Revegetation Process



# Surface and Subsurface Tillage Techniques



# Rome Disking

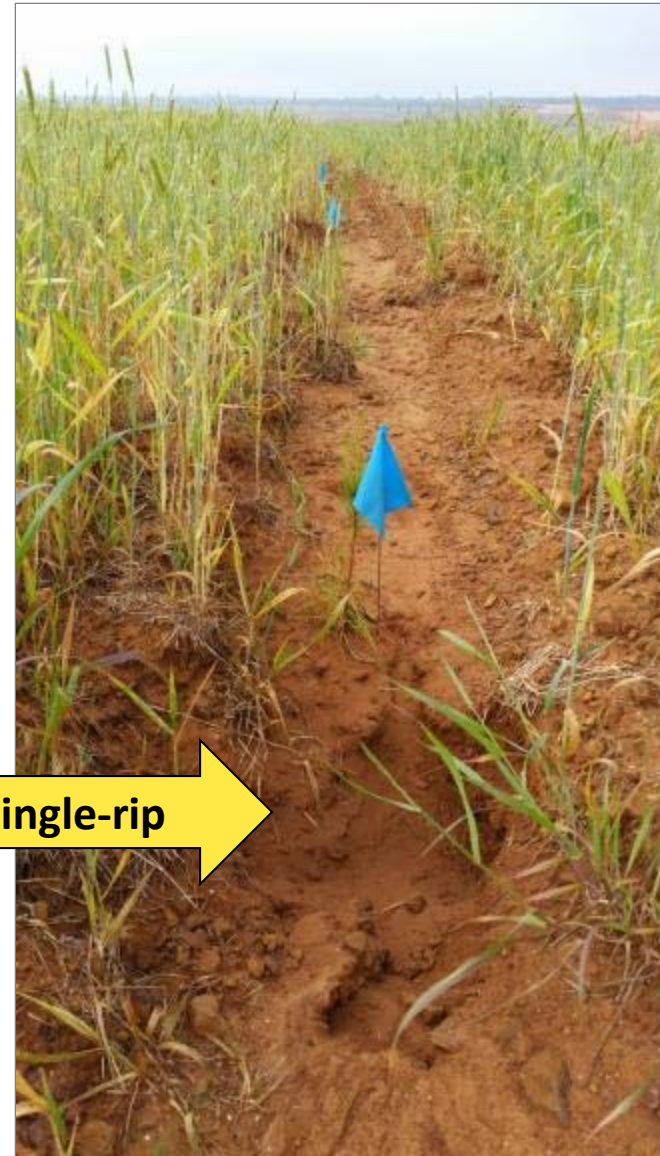


# D8 Dozer Ripping



# Disking + Ripping





Single-rip



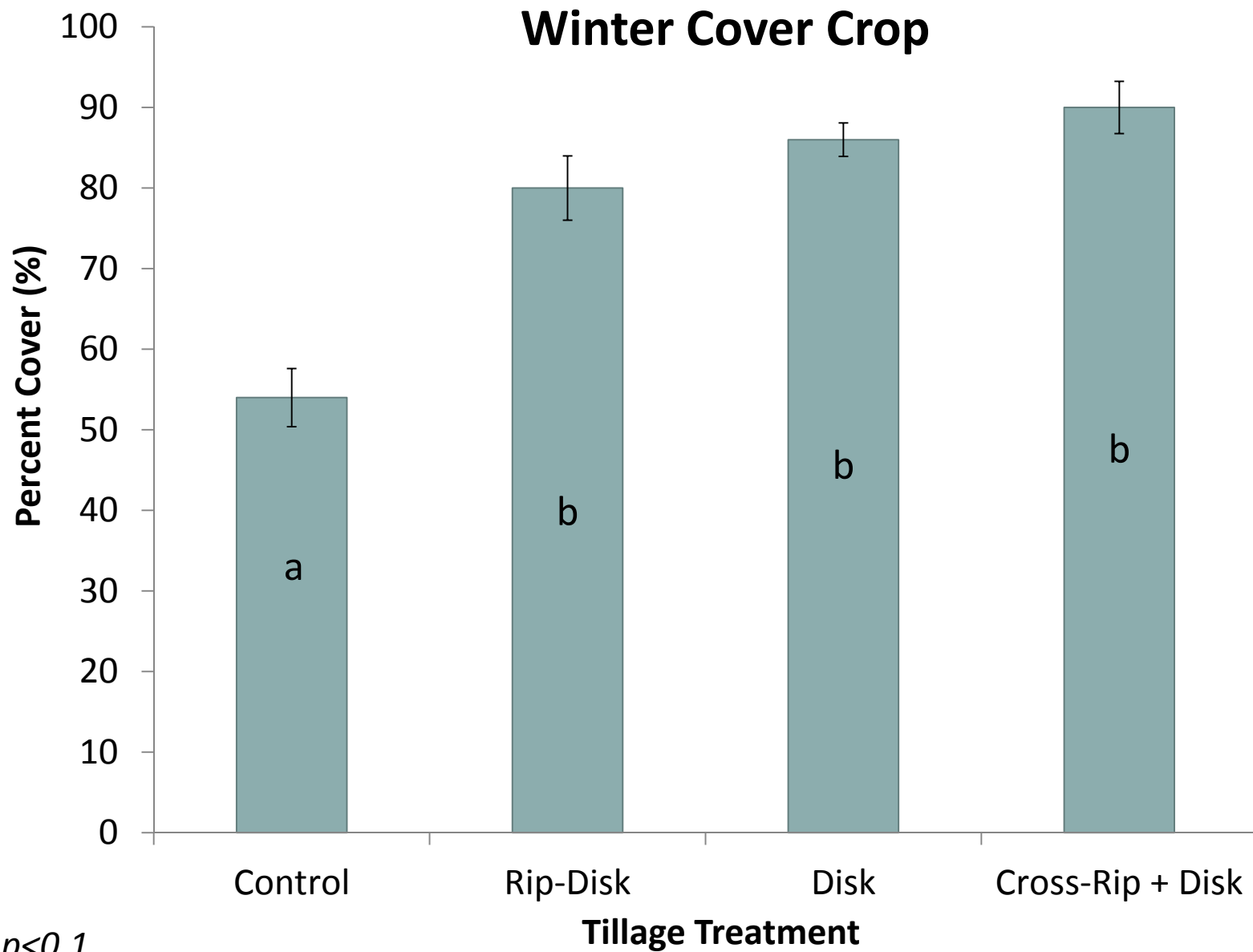
## Cross-rippled



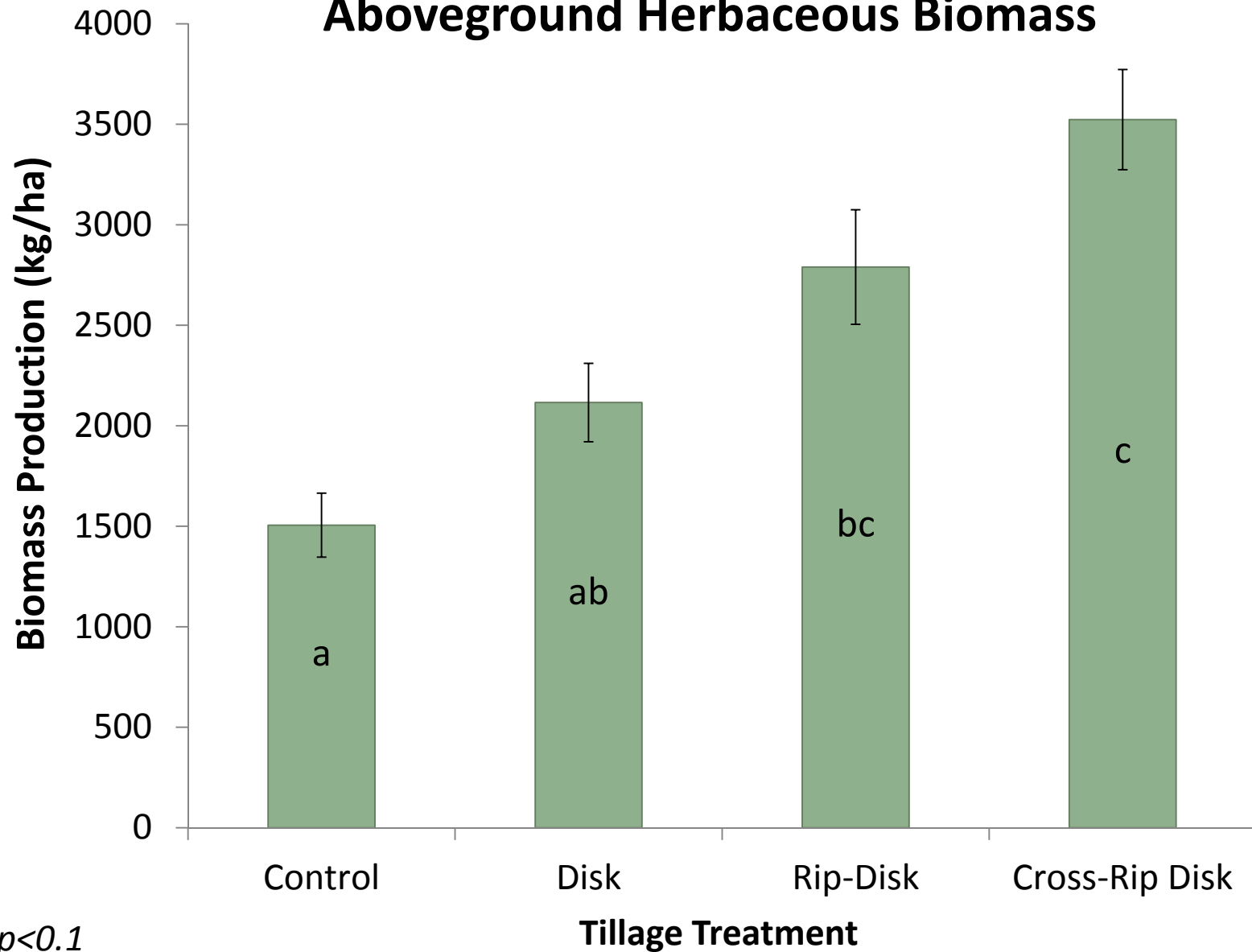
## Control







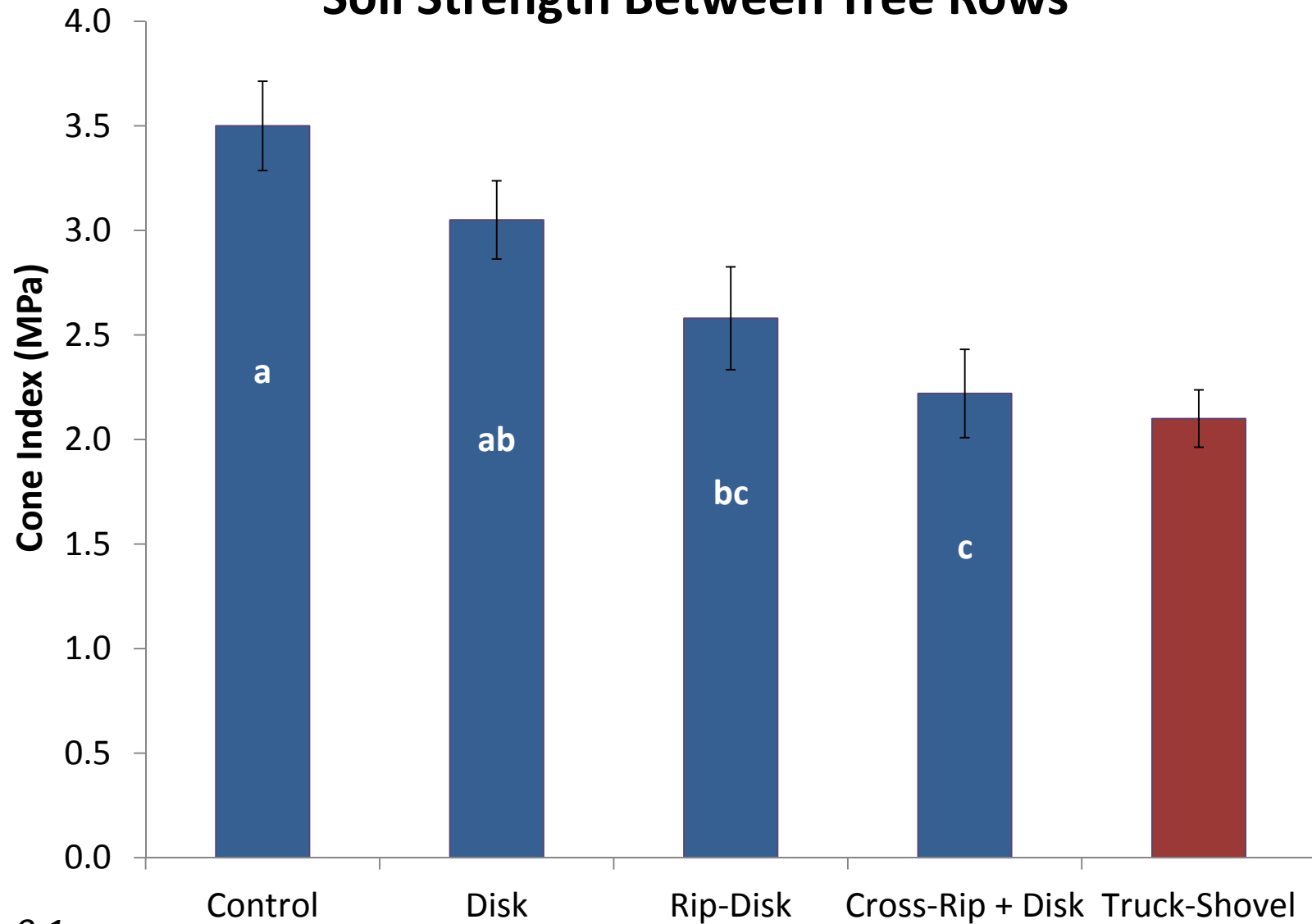
## Aboveground Herbaceous Biomass



$p < 0.1$



## Soil Strength Between Tree Rows



$p < 0.1$





- Soil physical properties
- Soil chemical properties



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- **Oak Hill Mine**

- **Appalachian Regional Reforestation Initiative**



**Any Questions?**

