



### Purpose/Utility of Research

#### Background

- The Oronogo-Duenweg Mining Belt Site is an inactive lead and zinc mining and smelting area Jasper County, Missouri.
- Operations ran from the mid 1800s to the 1970s, and included hundreds of mines and 17 smelters, which resulted in air emissions and fugitive dust contaminating soil over a large area.
- About 7,000 acres of land in Jasper County were contaminated with over 10 million tons of mining wastes.
- Analyses show that soil, ground water, and surface water are contaminated with lead, zinc, and cadmium from the mining and smelting activities.
- Exposure risks include ingestion of contaminated ground water, soil, or mine wastes.

#### Remedial Action

- Removal and burial of contaminated mine wastes and soil are the primary remedial activities.
- Removal generally leaves a coarse-textured sub-soil into which zinc and cadmium have leached from the mining waste overburden.

#### This Research Collaboration

- The challenge now is to establish sustainable plant growth on the metal-contaminated, coarse-textured sub-soil material that is exposed following site remediation.
- Region 7 and ORD are collaborating to develop soil amendments and management approaches to facilitate the establishment of a soil-stabilizing plant cover where previous attempts have failed.
- Amendments include biochar, compost and other amendments.

### Highlights



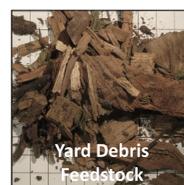
#### Project Objectives

- Demonstrate the effectiveness of native plant restoration and sorption of heavy metals in acidic mining impacted soils using well-characterized biochar products and other soil amendments.
- Specifically evaluate biochars derived from local feedstocks for their capacity to improve soil properties to sorb heavy metals, improve soil fertility, adjust soil pH, and improve soil water holding characteristics.
- Develop rapid and simple procedures for evaluating biochars and pairing their properties with specific acid mine soils to improve soil conditions and facilitate native plant establishment and growth.
- Demonstrate the effectiveness of selected biochar(s) to improve soil conditions to facilitate native plant establishment and growth at field research plots in the Oronogo-Duenweg mining belt area in the Tri-State Mining District, specifically in Jasper County, Missouri.

### Application & Translation

#### Biochar

- Carbon-rich solid produced by heating biomass in the absence of oxygen (pyrolysis)
- Usually made from waste biomass
- Porous solid with beneficial properties
  - Sorb contaminants to reduce exposure
  - Increase water infiltration and retention
  - Supply plant nutrients
  - Soil revitalization
- Properties are tunable by feedstock selection, control of pyrolysis conditions and possible other modifications



#### Revitalizing Degraded Soils

- Mining impacted and degraded soils are often barren and can be sources of contaminant exposure
- Strategic addition of soil amendments, including biochar, to these soils can provide a means of *in situ* remediation and create conditions to support the establishment of a soil-stabilizing native plant community
- Transitioning from barren land to a landscape with thriving plant cover reduces exposure and offsite movement of contaminants, increases carbon sequestration and the provision of ecosystem services
- In addition to biochar soil amendments can include: compost, lime, manure, yard debris, biosolids, log yard residuals

### Intended End Users

- The initial end users of this research are the Region 7 Remedial Project Managers responsible for remediating the historic mining wastes across Jasper County, Missouri
- Region 7 reached out to ORD for assistance because revegetation attempts of remediated land had consistently failed and a solution is needed
- One of the hallmarks of this research is the open dialogue and exchange of ideas and information between Region 7 and ORD scientists
- This research, while directly serving the needs of Region 7, will help address the extensive national issue of mining impacted and degraded soils

### Lessons Learned

- Regions need access to ORD scientists to help them solve complex regional problems
- Direct collaboration between Region 7 and ORD has been a fruitful, purpose-driven, problem-solving endeavor
- The characteristics of this collaboration include frequent and clear communication, good decision making, and keeping the goals and objectives of the research in focus
- Regional Project Managers and Superfund Technology Liaisons talk to each other and share information, which helps to disseminate knowledge and information
- Solving complex environmental problems, as the one described herein, takes forward-looking leadership, financial support, consistent effort and time to solve
- This research is supporting the development of biochar as a new tool for use in remediation that will have broad application and utility beyond Region 7