AGGREGATE STABILITY OF RECLAIMED MINESOIL COMPARED TO NATIVE SOIL

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Introduction

Restoring mine sites after major surface mining operations involves reclamation to restore soil functions within the landscape. The concept of soil quality links soil properties to the ability of the soil to support ecological systems. Aggregate stability is an early indicator of improved soil quality and can be used to evaluate progress of soil restoration activities. As reclaimed soils develop, stability of the reclaimed minesoil and development of the soil profile may occur in concert. The Gilt Edge Mine study site, located in the Northern Black Hills, Lead, South Dakota has been reclaimed for five years (Fig 1). Four sites were compared two reclaimed mine soils [(R1, R2): composed of 15cm topsoil plus 75cm ground mica schist] and two native soils (one burned in a recent forest fire in 2002, NB, and one unburned, NUB).

Objective

Compare aggregate stability and soil structure of a reclaimed mine soil after five years of reclamation compared to two native soils (one burned in a recent forest fire, NB, and one unburned, NUB).

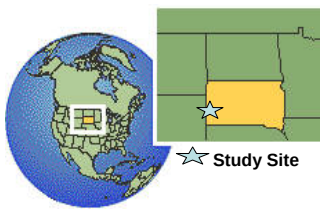

Figure 1. Gilt Edge Mine Superfund Site, South Dakota

Methods

Collection Sites (4)
- Reclaimed Mine Soils (R1, R2)
- Native Soils - Burned (NB), Unburned (NUB)
  - Grizzly Loamy-Skeletal, Mixed, Superactive, Frigid Glossic Hapludalfs
- All sites had similar landscape positions and slope

Data Collected
- Rose Design (Fig. 2)

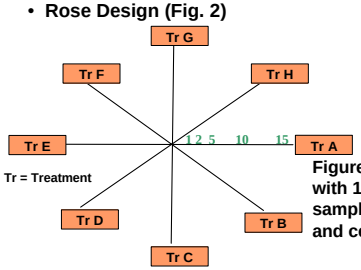

Figure 2. Rose Design with 15m transects and samples at 1, 2, 5, 10, 15m and center (0).

Sampling Depth
- 30cm diameter circle sampled to depth 10cm
  - Separated into fractions (>2mm, <2mm)

Center Pit Soil Structure Description
- Used Standard NRCS Procedures

Data Analyzed
- Aggregate Stability – Prehumidify procedure (Kemper & Rosenau, 1986)
- Spatial Distribution - Surfer 7

Results

Sample Site	Number of Samples	Mean	Standard Deviation
Reclaimed One	41	94.2	2.6
Reclaimed Two	41	94.7	2.6
Native Unburned	41	98.7	0.5
Native Burned	41	94.9	2.1

Table 1. Aggregate Stability for Reclaimed vs. Native Soil. R1, R2, and NB had similar standard deviations and means while NUB had lower standard deviation and higher mean.

Native Unburned Soil			Native Burned Soil		
Depth (cm)	Profile Description	Structure	Depth (cm)	Profile Description	Structure
-2-0*	O	SG			
0-3	AE	GR	0-4	AE	GR
3-21	EA	PL	4-12	EA	SBK
21-41	E1	PL	12-36	E1	SBK
41-65	E2	WK SBK parting to WK PL	36-56	E2	SBK
65-106	E3	WK SBK parting to WK PL	56-70	BE	SBK
106-125	EB	SBK	70-90	Bt	SBK

Table 2. Soil structure of NUB to NB. NUB has a more developed soil profile. *0 represents start of mineral surface; - indicates layer above the surface.

Reclaimed One Soil		Reclaimed Two Soil	
Depth (cm)	Structure	Depth (cm)	Structure
0-10	WK SBK	0-10	SM SBK to GR
10-20	WK SBK	10-20	SM SBK
20-30	WK SBK	20-30	SM SBK
30-40	WK SBK	30-40	SM SBK
40-50	WK SBK	40-50	SM SBK
50-60	WK SBK	50-60	SM SBK

Table 3. Soil structure of R1 and R2. There was structure development after five years of reclamation. R2 has a more developed soil profile.

Structure Abbreviations

Single Grain = SG	Granular = GR
Subangular Blocky = SBK	Platy = PL
Small = SM	Weak = WK

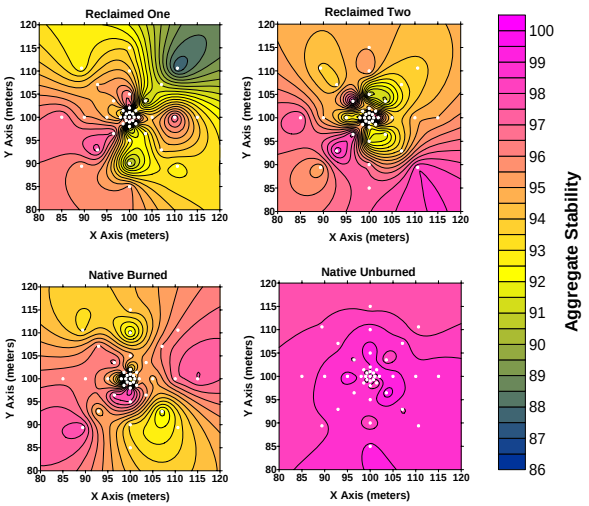

Figure 4. Spatial distribution of aggregate stability with sample sites. NUB was associated with less spatial variability and higher aggregate stability than NB, R1 and R2.

Summary

- The presence of a O horizon was associated with higher aggregate stability in the AE horizon.
- The spatial variability of the NUB site was lower than the other sites.
- The NB, R1, and R2 had similar aggregate stability and spatial variability.
- Soil structure formation in reclaimed soils occurred in the created subsoil (mica schist) within five years of reclamation.

References

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