

Soil Monitoring on the GMUG

Gina Rone

GMUG Forest Soil Scientist

May 17, 2023



Monitoring on the GMUG can be separated into 2 categories:

1. Evaluation of existing conditions

- Are proposed activity areas currently close to or exceed Regional and Forest Plan standards of 15%?
 - Identify special mitigation.
- Data collectors: soil scientist and trained personnel.

Monitoring Includes: compaction, displacement, rutting, puddling, erosion, severe burning, coarse woody debris, and organic matter.

2. Evaluation of post-harvest conditions

- Do treated activity areas meet or exceed Regional and Forest Plan standards of 15%?
- Observe how the outcome compares to desired conditions.
- Are current practices sufficient or is there a need for change to management actions?
 - Restoration needs
- Data collectors: soil scientist.

“DETRIMENTAL” SOIL CONDITIONS



- ▶ NFMA (1976) required research and monitoring to protect the permanent productivity of National Forests.

- ▶ To manage without “**substantial** and **permanent** impairment of the productivity of the land” and “soil, slope, or other watershed conditions will not be irreversibly damaged.”

Soil productivity is ...*“the inherent capacity of the soil resource to support plants”*

SUBSTANTIAL AND PERMANENT

► Substantial Soil Impairment:

- Detrimental changes in soil properties (physical, chemical, or biological) that result in the loss of the inherent ecological capacity or hydrologic function of the soil resource that lasts beyond the scope, scale, or duration of the project causing the change.

Permanent Soil Impairment:

- Detrimental changes in soil properties (physical, chemical, and biological) that result in the loss of the inherent ecological capacity or hydrologic function of the soil resource that lasts beyond a land management planning period.

Standards and Guidelines

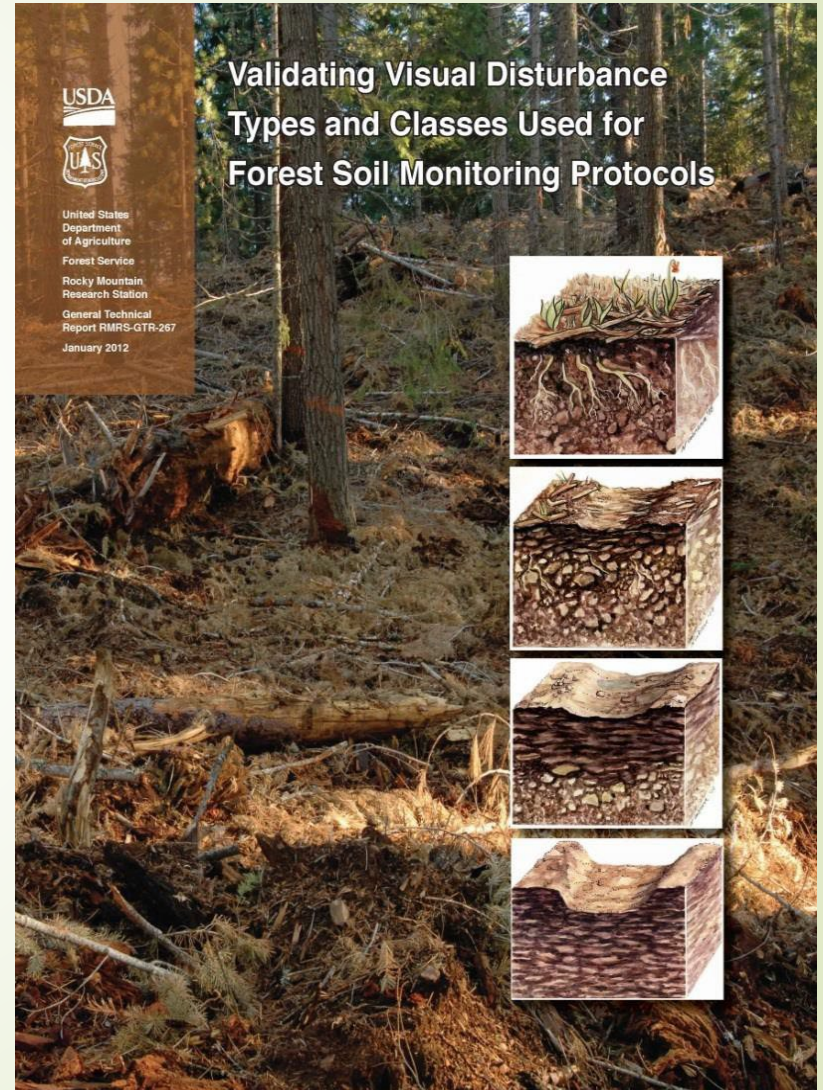
- **Standard:**
 - Leave a minimum of 85% of an activity area in an acceptable soil quality condition.
- **Guidelines:**
 - Maintain both fine and coarse woody material.

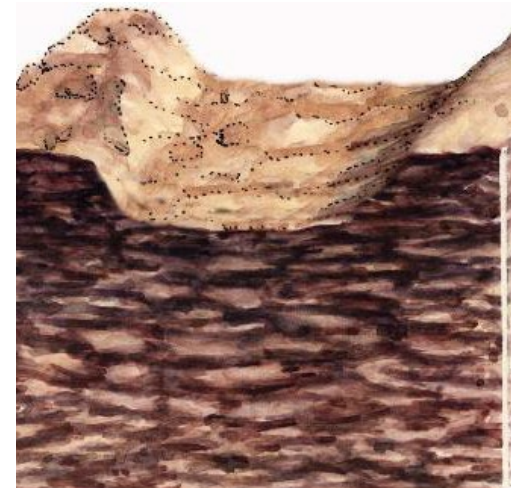
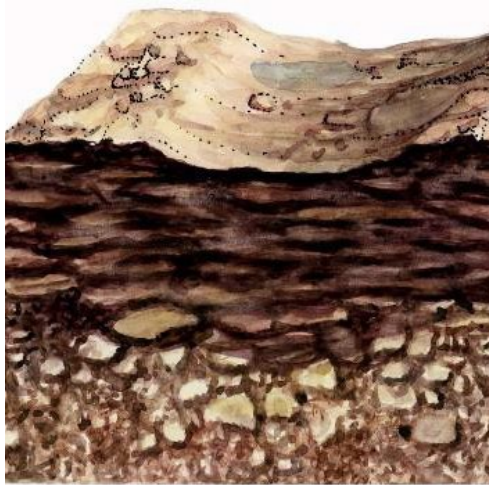


Soil Disturbance Monitoring

FS Soil Disturbance Monitoring Protocol (Page-Dumroese et al. 2009) includes several key components:

- Compaction
- Puddling
- Displacement
- Rutting
- Burned Soil
- Erosion





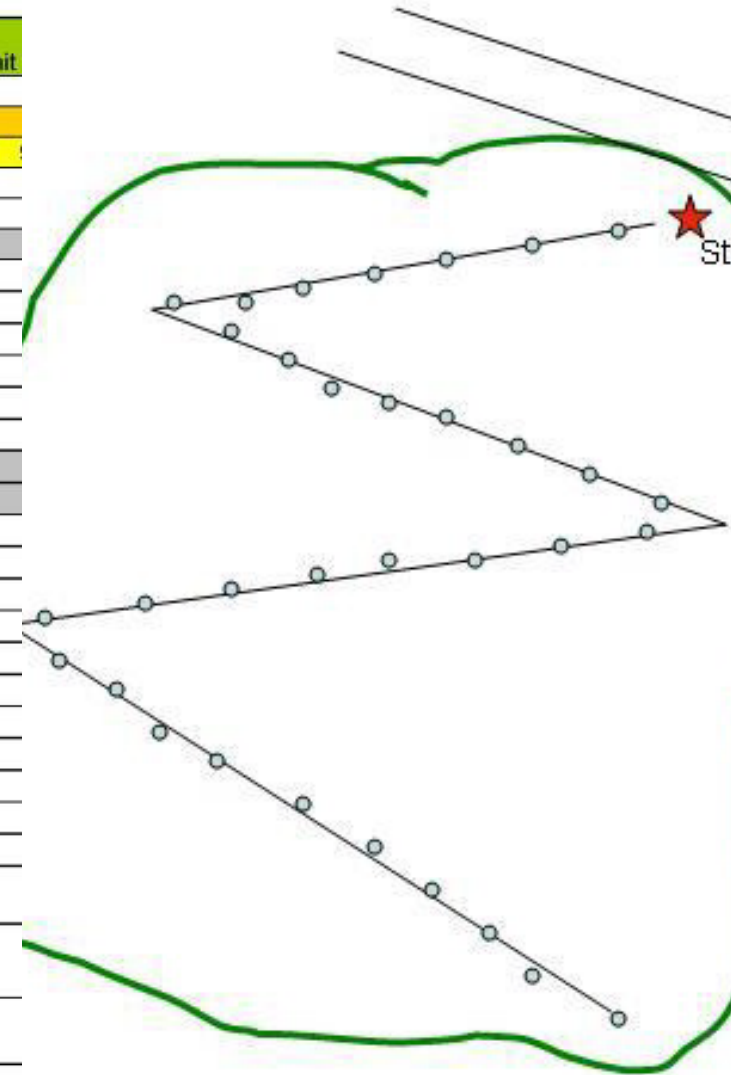
Roles of a Visual Guide – Soil Disturbance Monitoring

- Provides a common language.
- National application.
- Build on Long Term Soil Productivity (LTSP) data.
- Provides consistency in assessing key indicators.

Monitoring

- Standardized data collection form
- Qualitative
- Utilizes 4 disturbance classes
- Rows on form correspond to the disturbance class
- For example, if compaction is 10-30 cm (the 2nd compaction row), then the disturbance class is 2.
- Supplemented with coarse woody debris information (Brown's transects)

Project ID:								0	Unit
Date:								Monitoring Type:	
Direction:									
Sample point	1	2	3	4	5	6	7	8	
f. floor depth (cm):									
Forest floor Impacted?									
Live Plant?									
Invasive Plant?									
Fine Woody? <7 cm									
Coarse Woody? >7cm									
Bare Soil?									
Rock?									
	0								
Topsoil displacement?									
Erosion?, comment!									
Rutting? <5cm									
Rutting? 5-10cm									
Rutting? >10cm									
Burning light									
Burning moderate									
Burning severe									
Compaction? 0-10 cm									
Compaction? 10-30 cm									
Compaction? >30cm									
Platy/Massive/Puddled structure 0-10 cm									
Platy/Massive/Puddled structure 10-30 cm									
Platy/Massive/Puddled structure >30 cm									
Mixed topsoil/subsoil									



Class 0 - Undisturbed

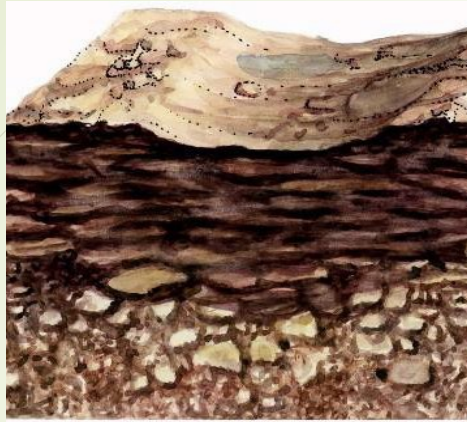
► Soil surface:

- No evidence of compaction, i.e., past equipment operation, ruts, skid trails.
- No depressions or wheel tracks evident.
- Forest floor layers present and intact.
- No soil displacement evident.
- No management-generated soil erosion.
- Litter and duff layers not burned. No soil char. Water repellency may be present.



Soil Disturbance Class 1

Soil Surface:



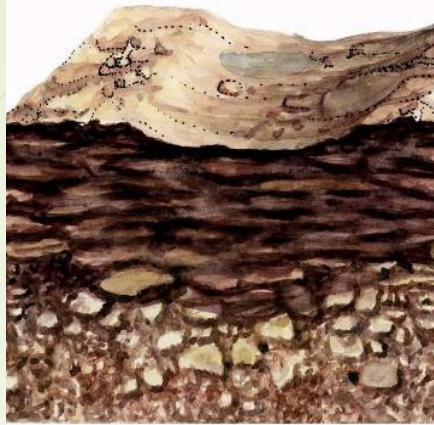
- Faint wheel tracks or slight depressions evident and are <math>< 5\text{ cm}</math> deep.
- Forest floor layers present and intact.
- Surface soil not been displaced, shows minimal mixing with subsoil.
- Burning light: Depth of char <math>< 1\text{ cm}</math>. Litter charred, or consumed, duff largely intact. Water repellency is similar to pre-burn conditions.

Soil Compaction:



- Compaction in surface soil slightly greater than observed natural conditions; concentrated from 0-10 cm in depth.
- Change in soil structure from crumb or granular structure to massive or platy structure, restricted to surface 0-10 cm.
- Fine, medium, and large roots can penetrate or grow around the platy structure. No "J" rooting is observed.
- Platy structure is non-continuous.
- Erosion is slight.

Soil Disturbance Class 2



Soil Surface:

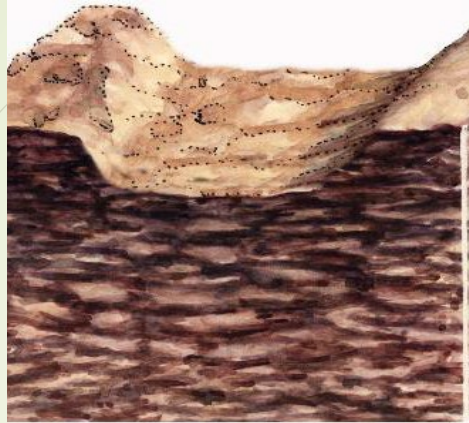
- Wheel tracks or depressions are 5-10 cm deep.
- Forest floor layers partially intact or missing.
- Surface soil partially intact and may be mixed with subsoil.
- Burning moderate: Depth of char 1-5 cm. Duff deeply charred or consumed. Surface-soil water repellency increased compared to the pre-burn condition.

Soil Compaction:

- Increased compaction from 10-30 cm depth.
- Change in soil structure (granular to platy or massive) from 10-30 cm.
- Large roots may penetrate platy structure, but fine and medium roots may not
- Erosion is moderate

Soil Disturbance Class 3

Soil Surface:



- Wheel tracks and depressions highly evident with depth >10 cm.
- Forest floor layers are missing.
- Evidence of surface soil removal, gouging, and piling.
- Majority of surface displaced and may be mixed with subsoil. Subsoil partially or totally exposed.
- Burning High: Depth of char > 5 cm. Duff and litter layer completely consumed. Surface soil is water repellent, reddish or orange in places.

Soil Compaction:

- Increased compaction is deep in soil profile (>30 cm).
- Change in soil structure from granular to massive or platy extends beyond 30 cm in depth.
- Platy structure is continuous.
- Roots do not penetrate the platy structure.
- Erosion is severe and has produced deep gullies or rills.



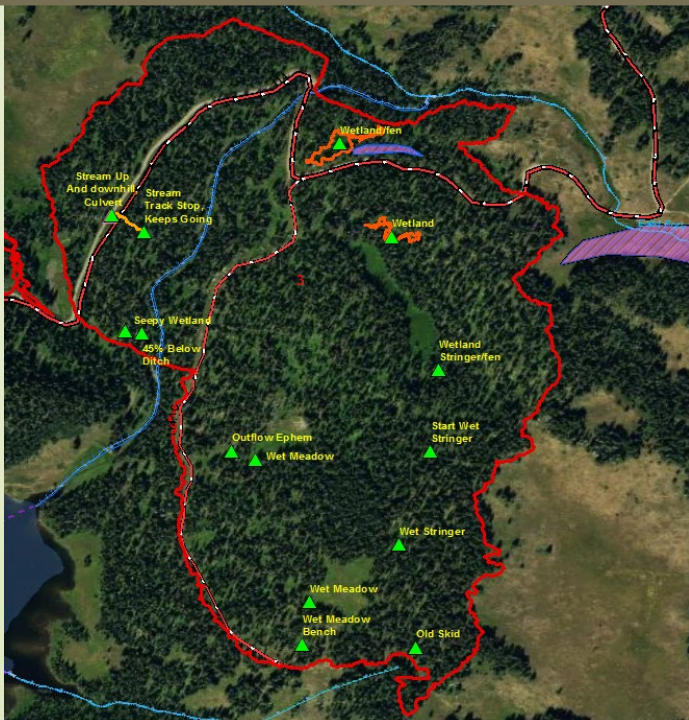
Main Causes of Soil Impacts

- Skid trail spacing
- Travel patterns





Lessons Learned: Main Causes of Soil Impacts



- Traditional equipment on steep slopes
- Lack of ground verification & exclusion



Lessons Learned: Main Causes of Soil Impacts

Roads ↔ Temp Roads



Lessons Learned: Main Causes of Soil Impacts

- Burn piles
- Landings



2021 Post-harvest Soil Monitoring

- Monitored 34 treatment units in 11 timber sales
- 3 out of the 17 SBEADMR units exceeded 15%
- Primary disturbance reasons:
 - rutting on skid trails
 - compaction
 - untreated burn piles (not scarified/seeded)
 - too many burn piles
 - isolated erosion due to lack of ground cover or waterbars
 - Temporary or non-system roads, especially when only closed but not scarified

Summary of 2021 post-treatment soil disturbance monitoring.

Timber Sale	Year Accomplished/Closed	Treatment Units	
		Soil Disturbance %	
SBEADMR		≤15%	>15%
Cooler	3/2020	3	1
High Mesa	4/2019	1*	1
Horse Mountain	11/2019	1*	0
Skeleton	7/2020	7	0
Willow	11/2020	2	1
Subtotal		14	3
Non-SBEADMR (6 sales)	2018 - 2021	18	1
Total		32	4

*at 15%.

Meeting “Y”OUR” Expectations

- Accomplishments without compromise
- Pro-active vs. retroactive
- Account for circumstances
- Resilience & Recovery

