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Ground Cover
Application
for Mine
Reforestation in the
Eastern U.S.

UNIVERSITY OF TENNESSEE

Department of Forestry, Wildlife and Fisheries

FORESTRY RECLAMATION APPROACH

- 1. Create a suitable rooting medium for good tree growth that is no less than 4 feet deep and comprised of topsoil, weathered sandstone, and/or the best available material
- 2. Loosely grade the topsoil or topsoil substitutes established in step one to create a non-compacted growth medium

3. USE GROUND COVERS THAT ARE COMPATIBLE WITH GROWING TREES

FRA #6

- 4. Plant two types of trees – 1) early succession species for wildlife and soil stability, and 2) commercially valuable crop trees
- 5. Use proper tree planting techniques

Stratifying your site

Depending on how variable your materials and topography are, it may be helpful to delineate 2 or more “habitat types” across your landscape.

These are often based on material type, or moisture.



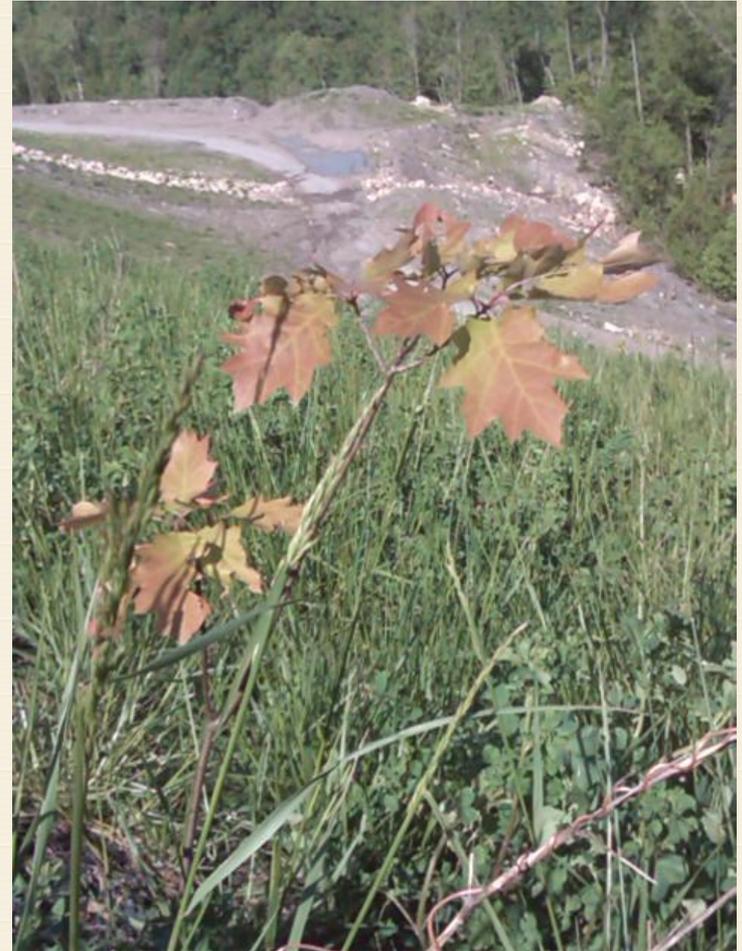
Stratifying is not always possible

- Where materials or moisture varies across a small area.

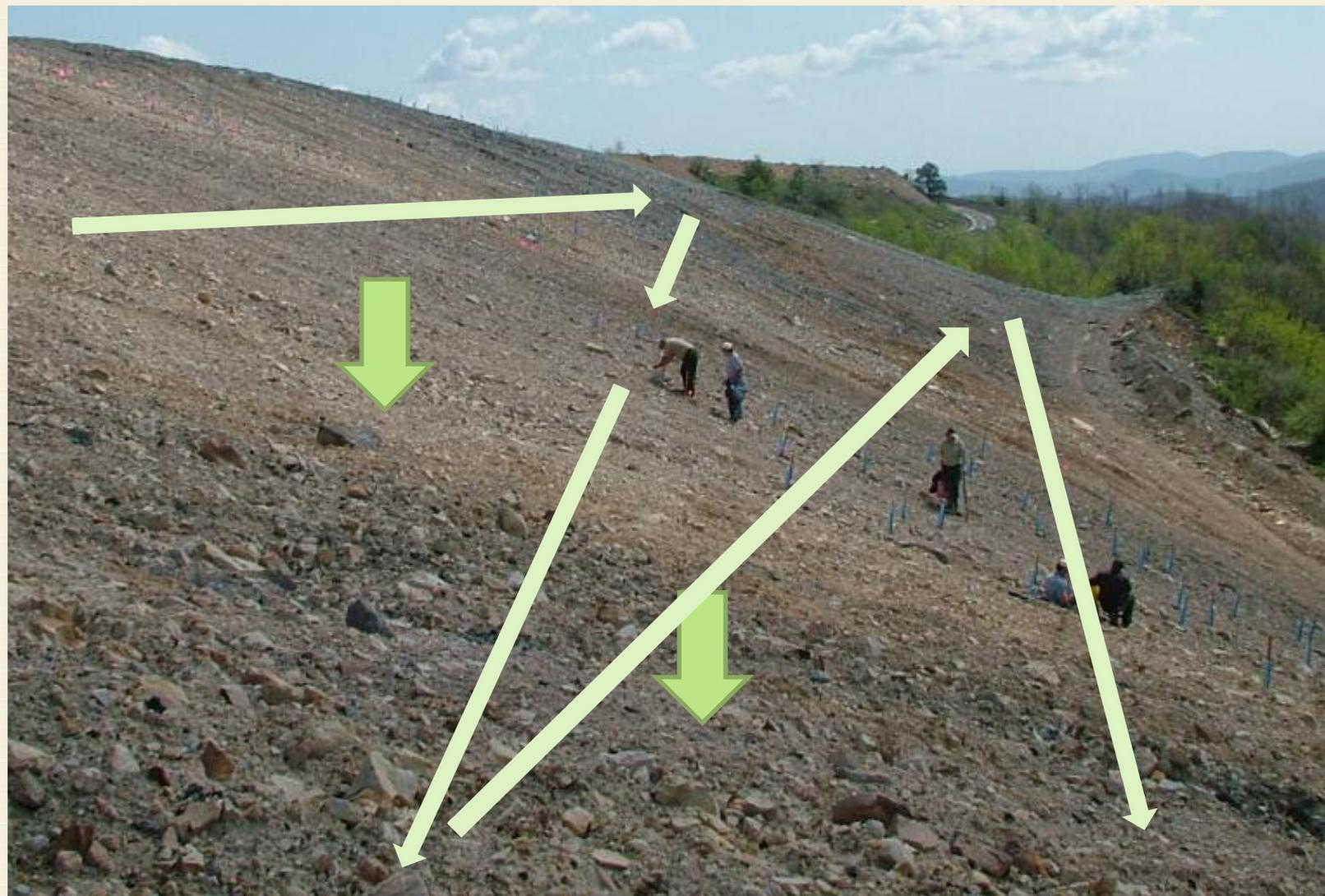


Soil testing

- Native plants grow best when soil chemistry is similar to native soils.
- Amendments often needed to adjust pH, and add nutrients.
- Site-specific amendments and ground covers needed to ensure success.
- Specify “Wildlife”, “Conservation”, or “Forestry” when sending soil to the lab.



Materials vary in chemistry- soil sample should include range of materials



Amendments

Soils for reforestation should be slightly acidic and have fewer nutrients than soils for grasslands

WHAT TO DO IF TEST RESULTS SHOW:

- The soil pH is below 5.5: The majority of the species here mentioned are in the range of 5.5-7.5

pH	Lime
pH < 5.5	lab lime recommendation multiplied by 0.70 when lime is applied in the hydroseed mix
pH > 5.5	None

Only add lime when the pH is low

- Phosphorus is less than 50 mg/Kg

Nutrient	pH	Fertilizer
P < 50 mg/Kg	< 5.5	Apply as di-calcium phosphate
	> 5.5	Apply as ammonium sulfate + triple super phosphate

Table

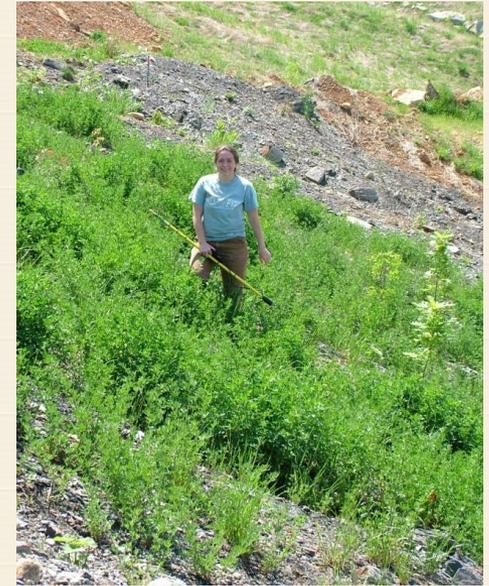
Fertilizer

- Nitrogen (N) 50-75 lb/ac
- Phosphorus (as P) 80-100 lb/ac **IF NEEDED**
- (as P₂O₅) 180-230 lb/ac

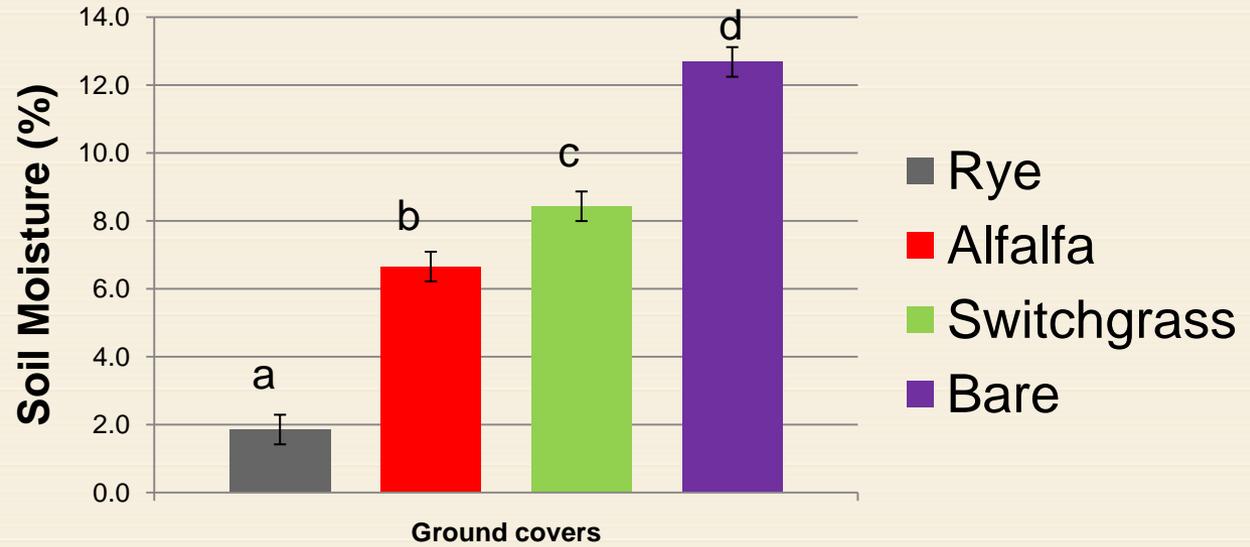


Tree-compatible ground covers:

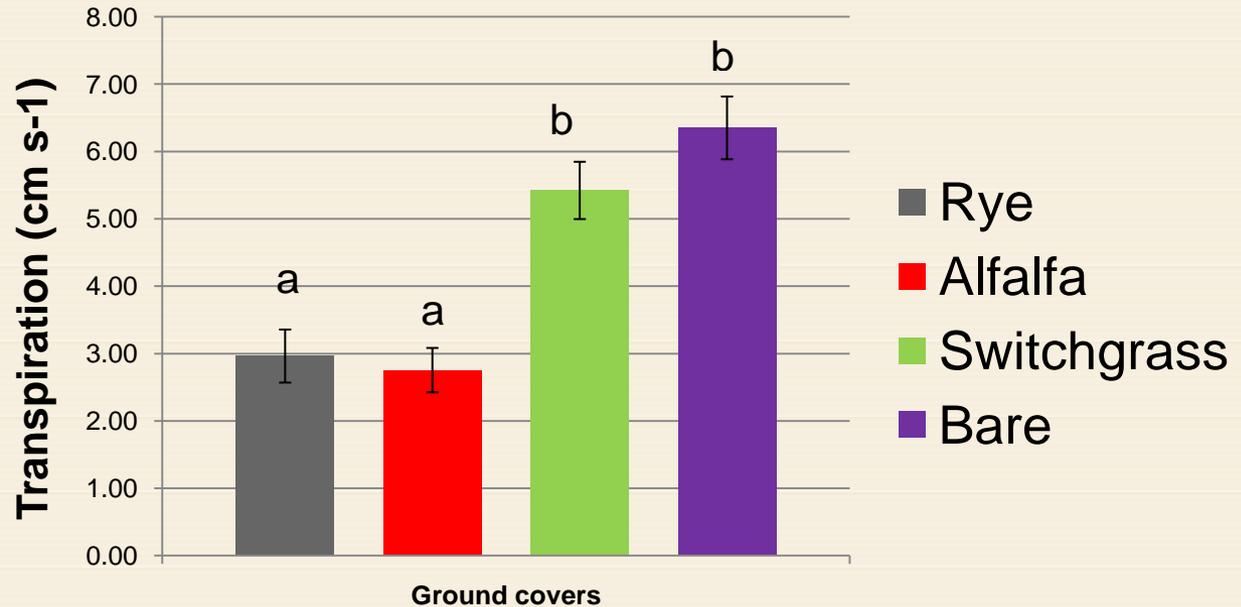
- Are low-growing so sunlight reaches the tree seedlings.
- Withdraw water and nutrients from the soil slowly.
- Do not cover the ground rapidly or completely to allow native seed to colonize.
- Allows rapid establishment and growth of native trees which minimizes the invasion of exotics.
- Less attractive to animals such as deer and rodents that may damage tree seedlings.



Soil Moisture on 5/19/2010



Oak transpiration on 5/19/2010



Selecting ground cover species

Common name	Latin name	lb/acre	seed/lb	pH	Soil Moisture		seeding time
					Wet	Dry	
Annuals							
winter wheat	Capture applied fertilizer						
buckwheat	Reduce erosion						
oats	Build soil						
browntop millet							
foxtail millet							
partridge pea (Leg)							
Austrian winter peas (Leg)	<i>Pisum sativum</i>	60	4,500	6.0-7.5		x	Aug-Oct
annual rye	<i>Lolium multiflorum</i>	15	200,000	5.0-7.5	x	x	Aug.-Oct
Legumes							
red clover	Capture nitrogen						
birdsfoot trefoil	<i>Lotus corniculatus</i>	8	500,000	4.5-6.5	x		Mar-Jun
Ladino clover	<i>Trifolium repens</i>	12	800,000	5.0 - 7	x		Mar-Jun, Aug-Oct
alfalfa	<i>Medicago sativa</i>	12	90,000	5.5 - 7		x	Mar-Jun, Aug-Oct
barrel medic	<i>Medicago trunculata</i>	8	100,000	5.2-8		x	Aug-Oct
Perennials							
perennial rye	Nutrient cycling						
timothy	Build soil						
orchardgrass	Promote succession						
coreopsis							
purpletop							
little bluestem							
indian grass	<i>Sorghastrum nutans</i>	7	175,000	5.5-7.0	x		Mar-May
switchgrass	<i>Panicum virgatum</i>	6	389,000	5.5-7.0	x	x	Mar-May
sideoats grama	<i>Bouteloua curtipendula</i>	15	160,000	5.5-7.0	x	x	Mar-May
big bluestem	<i>Andropogon gerardii</i>	7	165,000	5.5-7.0	x	x	Mar-May
eastern gamagrass	<i>Tripsacum dactyloides</i>	8	45,000	5.5-6.0	x		Dec-Jun
broomsedge bluestem	<i>Andropogon virginicus</i>	10	800,000	5.0-7.0		x	Mar-Jun

Seed mix

The annual density of the annual component should be reduced in spring and summer, because the perennials will be establishing at the same time.

SEEDING MIX	Full Rate Lb/Ac PLS A	Target Density (%cover/100) B	Seeding Rate Lb/Ac C=AxB
Annuals (Select only 1)		Fall=100% Winter=70% Spring=40% Summer= 50%	
winter wheat	70		0
buckwheat	35	40%	14
oats	15		0
browntop millet	25		0
partridge pea (Leg)	10		0
Austrian winter peas (Leg)	60		0
annual rye	15		0
Annuals		40%	14

During spring the target density is equal to 40%. For buckwheat we would use 35 lb/ac for a density of 100%, so we will use 14 lb/ac.

Seeding rate = (3 Text Box 4) = 14 lb/ac

Seed mix

SEEDING MIX	Full Rate Lb/Ac PLS A	Target Density (%cover/100) B	Seeding Rate Lb/Ac C=AxB
Legumes (Select 1 or more)			
red clover	12		0
birdsfoot trefoil	8	20%	1.6
Ladino clover	12		0
alfalfa	12	20%	2.4
barrel medic	8		0
Perennials (Select 2 or more)			
coreopsis	4		0
purpletop	20		0
little bluestem	10	10%	1
indian grass	7	10%	0.7
switchgrass	6	10%	0.6
sideoats grama	15		0
big bluestem	7		0
eastern gamagrass	8		0
broomsedge bluestem	10		0
Perennials ≤ 70%		70%	6.3
TOTAL SUM Lb/Ac (Annual+Perennial+Legumes)			20.3

The total percentage of legumes + perennials should be less than or equal to 70%

For this example we selected:

Birdsfoot trefoil (20%) = 1.6 lb/ac

Etc.

Legumes + Perennials = 6.3 lb/ac

Total sum Lb/Ac seed mix = 20.3

How many species to seed?



More species =
less chance of
cover dense
Growth over a
Diversity of all
Variety of
seasons out
materials and
moisture



Sites seeded with native warm season grasses are slow to establish, but result in a diverse mixture of grasses and forbs.

2006



2008



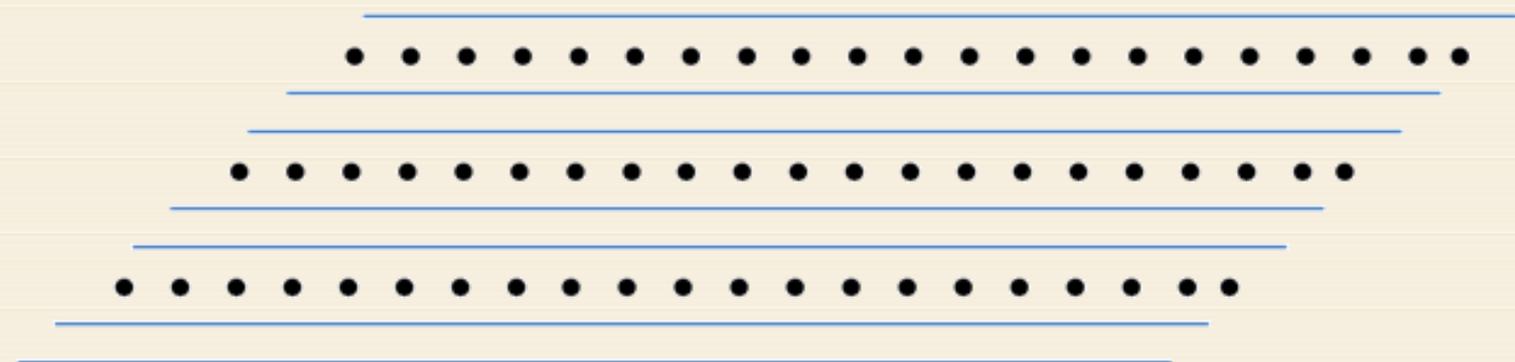
FIELD PROTOCOL FOR EARLY ASSESSMENT OF GROUNDCOVER SPECIES

1. Divide the site in equally spaced horizontal survey strips than can be walked from one end to the site to the other (Figure 1). The more strips better as time permits.



Figure 1. Site divided into survey strips

2. Walk down the center of each strip in a linear fashion, and stop approximately every 20 feet to survey groundcover establishment (Figure 2). For most people, a distance of 20 feet is covered in 7-8 paces.



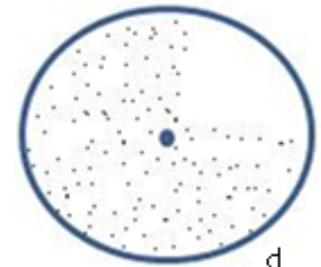
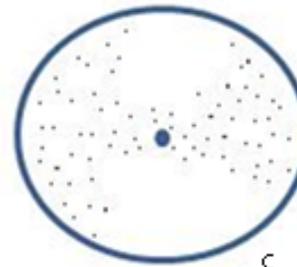
Data sheet

Point	Passed	Point	Passed	Point	Passed
1		26		51	
2		27		52	
3		28		53	
4		29		54	
5		30		55	
6		31		56	
7		32		57	
8		33		58	
9		34		59	
10		35		60	
11		36		61	
12		37		62	
13		38		63	
14		39		64	
15		40		65	

Site: _____

Date: _____

Pass



Fail

