

The background image shows a large-scale mining and reclamation operation. On the left, a large yellow dump truck is dumping material onto a pile. In the center and right, there are large mounds of earth and rock. A yellow bulldozer is visible on the right side, working on the terrain. The overall scene is a hilly, open-pit mine area with heavy machinery and large piles of material.

FORESTRY RECLAMATION APPROACH (FRA)

STEP #2:


PLACING THE FORESTLAND GROWTH MEDIUM TO MINIMIZE COMPACTION

**AMERICAN SOCIETY OF MINING AND RECLAMATION (ASMR)
&
APPALACHIAN REGIONAL REFORESTATION INITIATIVE (ARRI)**

JOINT CONFERENCE, LEXINGTON, KY JUNE 8, 2015

**Loosely grade the topsoil or topsoil
substitutes to create a non-compacted
growth medium**

NON-COMPACTED SOILS PROMOTE TREE GROWTH AND ECOLOGICAL SUCCESSION

- 
- A grayscale background image showing a construction site. On the left, a large dump truck is parked with its bed raised. On the right, a bulldozer is visible, pushing a large pile of earth. The ground is uneven and appears to be recently disturbed.
- Increased porosity**
 - Decreased bulk density**
 - Allows better infiltration of rain water**
 - Allows soil to hold more water and air**
 - Allows roots to grow more freely**
 - Makes proper tree planting much easier**

Soil bulk density...

- Bulk density (BD) is the ratio of the dry soil mass to bulk soil volume, including pore space. It is usually expressed in grams per cubic centimeter.
- As the dry BD of soil increases, tree survival and growth rates decrease.
- Tree survival begins to decrease rapidly when dry BD reaches about 1.5 - 1.7 grams/cubic cm.

The background of the slide is a grayscale photograph of a construction or land-clearing site. On the left, a large dump truck is partially visible, its bed raised. In the center and right, a bulldozer is working on a dirt mound. The overall scene is hazy, suggesting a dusty or overcast environment.

SOIL COMPACTION HINDERS TREE SURVIVAL AND GROWTH

- VT 1992: Reducing soil compaction increases tree survival and growth rates and decreases soil erosion**
- UK 2006: Uncompacted sites increase tree survival and tree growth rates compared to compacted sites**
- WVU 2006: Hardwood trees planted on uncompacted soil increases tree survival**

FRA GRADING

- Backfill is placed and compacted using current practices to ensure mass stability (1.3 static safety factor)
- Final layer is the growth medium, 4 feet deep and uncompacted
- No tracking-in with dozers
- No equipment with rubber tires









GROWTH MEDIUM PLACEMENT ON FLAT TO MODERATE SLOPES

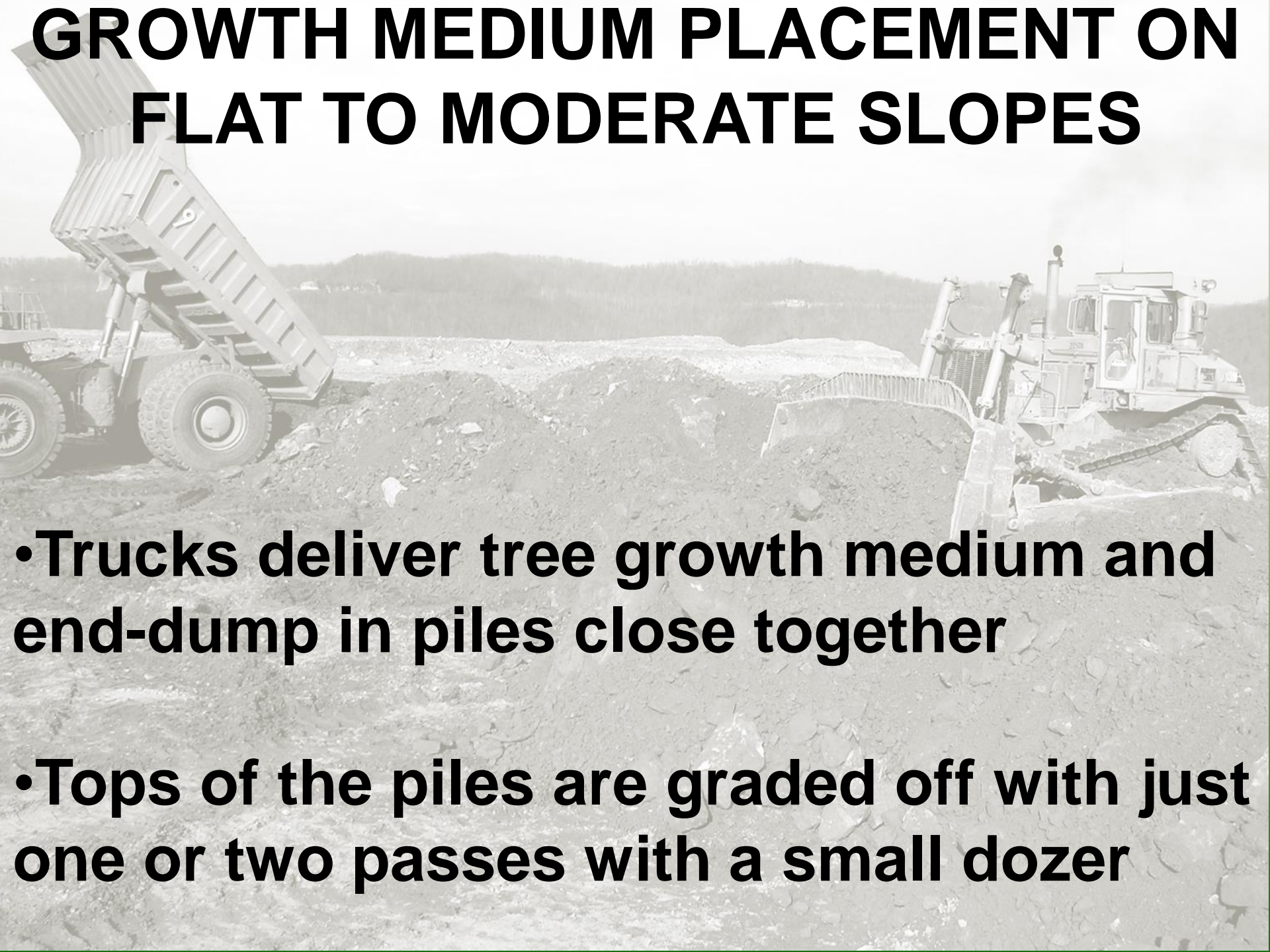
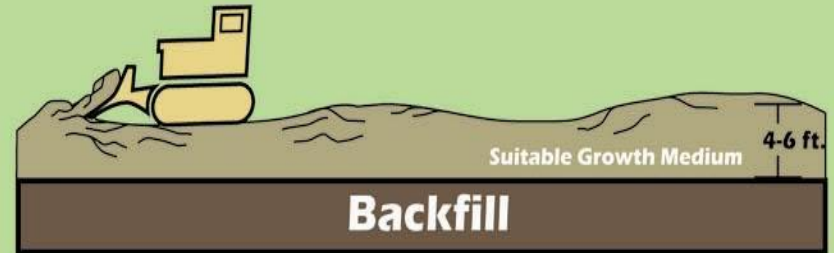
- 
- Trucks deliver tree growth medium and end-dump in piles close together
 - Tops of the piles are graded off with just one or two passes with a small dozer

DIAGRAM 1. AREA MINING OR MOUNTAINTOP REMOVAL METHODS



Ohio



Kentucky



West Virginia



Tennessee















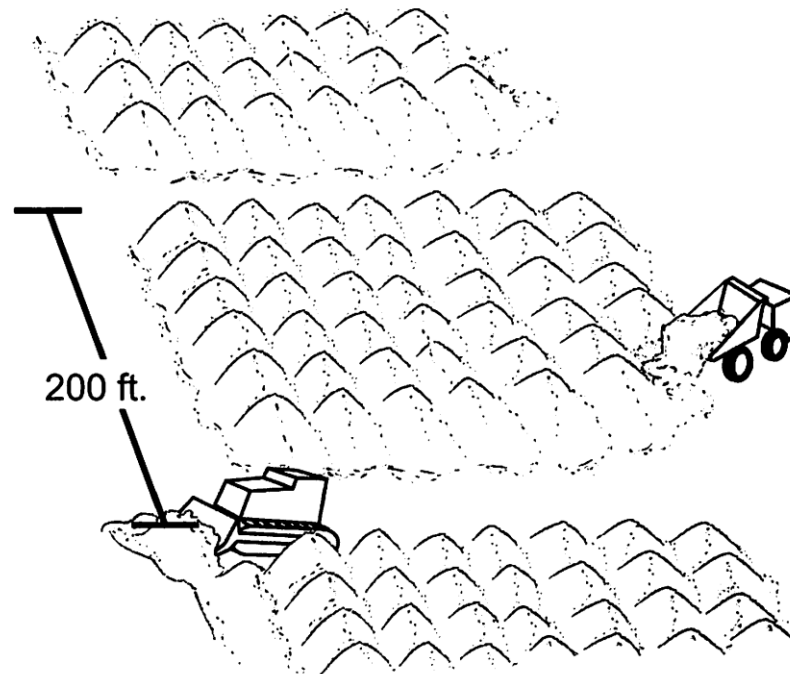
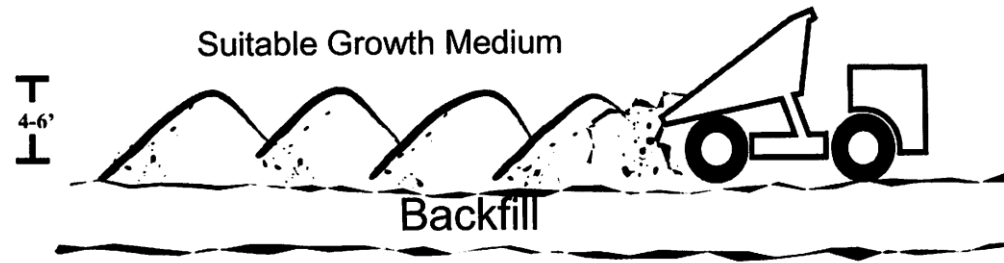


Diagram 4.

***Area Mining or Mountaintop Removal Reforestation Option
for Commercial Forestland***



06/10/2010









COMMERCIAL FORESTRY GROWTH MEDIUM, WV SITE



COMMERCIAL FORESTRY GROWTH MEDIUM, WV SITE











KY RAM 144:

allows for no
strike off

need landowner
approval

need
commercial
woodland
planting plan

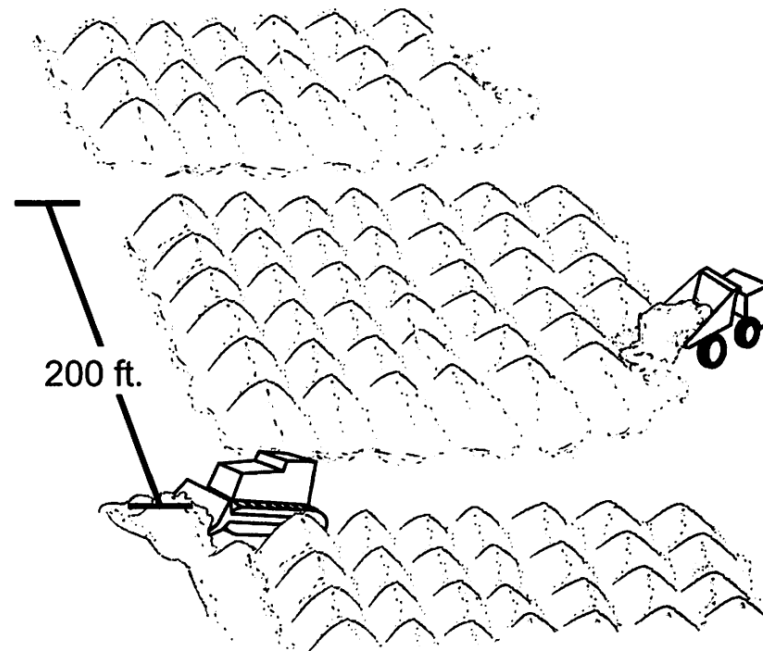
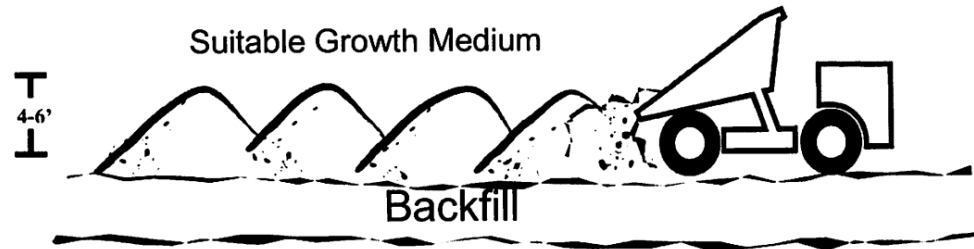


Diagram 4.

*Area Mining or Mountaintop Removal Reforestation Option
for Commercial Forestland*



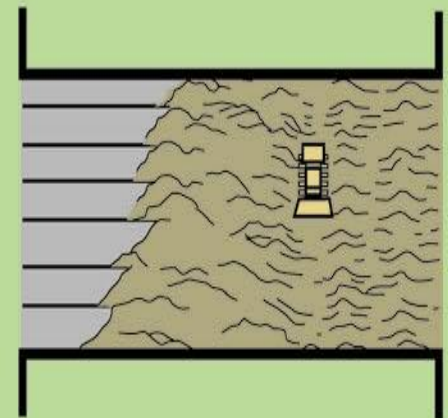


GROWTH MEDIUM PLACEMENT ON SLOPED AREAS

- **Backfill or mine spoil is placed and compacted to eliminate highwall and ensure mass stability**
- **Growth medium or mine soil is placed on the surface as the final layer**
- **Leave interface rough to prevent creating a slip plane**
- **Final grade with small dozer or track-hoe**

DIAGRAM 3. CONTOUR MINING OR OTHER SLOPED AREAS

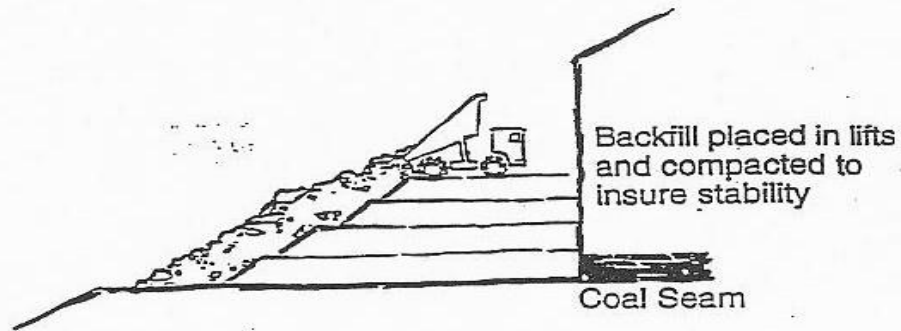
Recommend no more than two passes with equipment to remove excessively large rocks and shape to final backfill configuration.











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

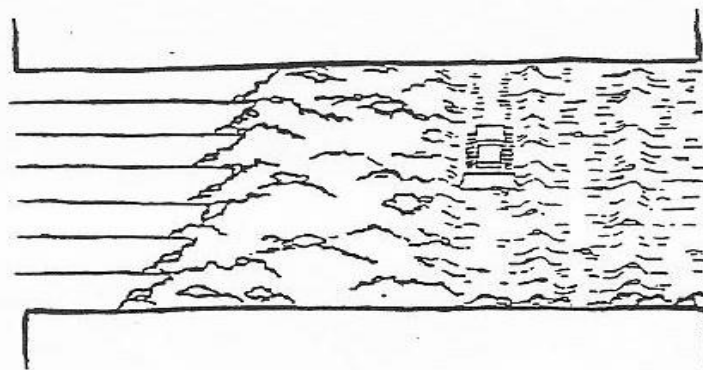
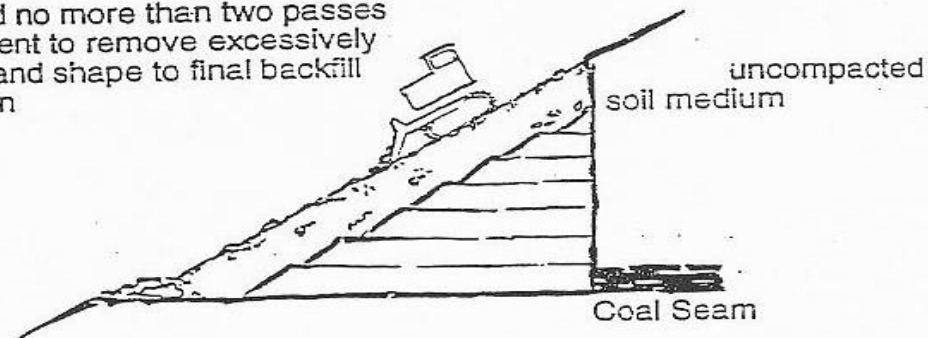


Diagram 3. Contour Mining or Other Sloped Areas

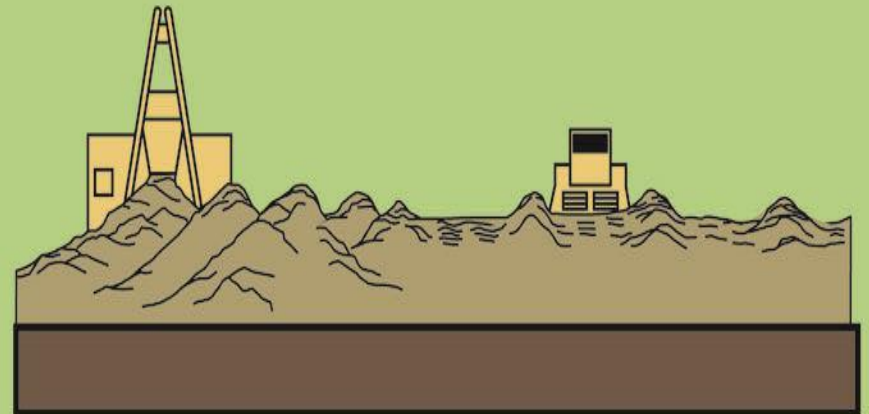
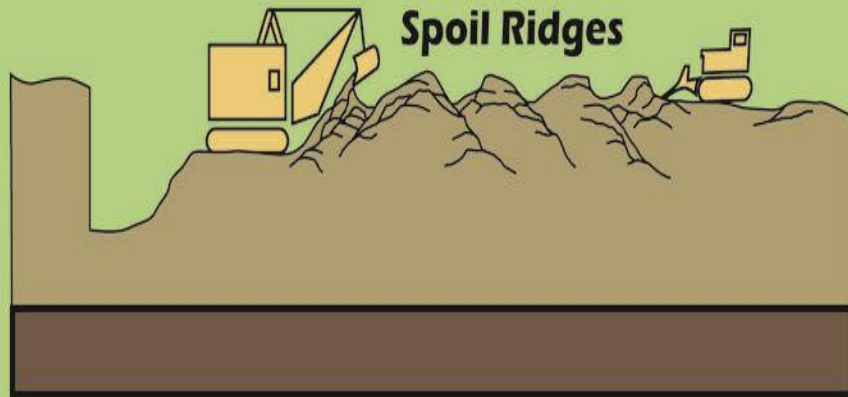


GROWTH MEDIUM PLACEMENT ON DRAGLINE OPERATIONS



- **Overburden material is cast in close piles or ridges**
- **Grade piles with small dozer one pass**
- **No tracking-in**
- **No equipment with rubber tires**

DIAGRAM 2. AREA MINING OR MOUNTAINTOP REMOVAL BY DRAGLINE METHOD.





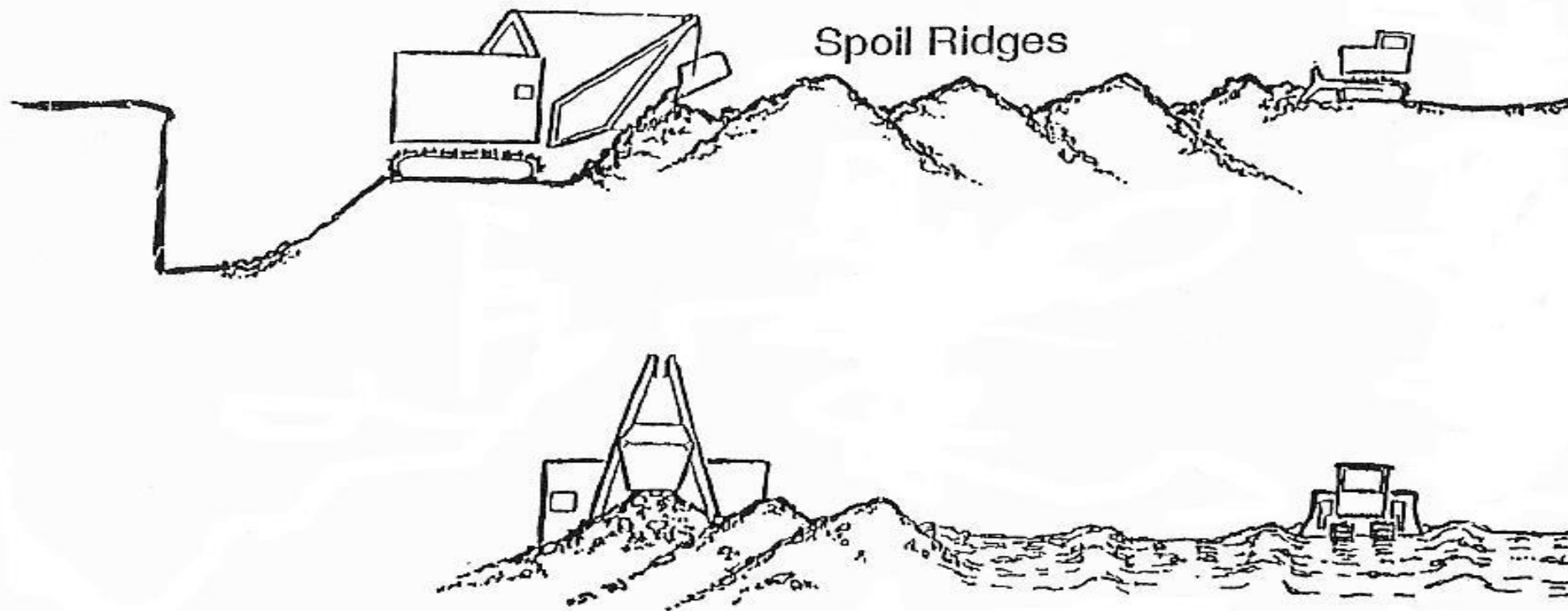


Diagram 2. Area Mining or Mountaintop Removal by Dragline method

Illustrations not to scale



LEAVE A ROUGH SOIL SURFACE

- **Resembles natural forest topography**
- **Increases water infiltration**
- **Reduces runoff and flooding potential**
- **Helps capture and germinate native seed**



SEP 24 2003



11/03/2010



FINAL GRADE DURING DRY CONDITIONS

- **Will reduce soil compaction**
- **More efficient final grading operation**

KEEP TRAFFIC OFF FINAL SURFACE

- **All equipment, especially those with rubber tires, will compact final grading**

SOIL COMPACTION CAN BE REDUCED THROUGH DEEP RIPPING





























01/18/2008



KOMATSU

b Brandeis

GALEO

b Brandeis UNIT 336

01/18/2008



01/18/2008





**Department of Environmental Protection
working for you to restore our environment**

Governor Tom Corbett – Secretary Michael L. Krancer

This Project is restoring 22.5 acres

**Abandoned Mine Land Reclamation Project
Contract No. OSM 16(0886,3316)101.1**

In Cooperation with the Federal Office of Surface Mining
with fees paid by the Coal Industry

12/07/2012



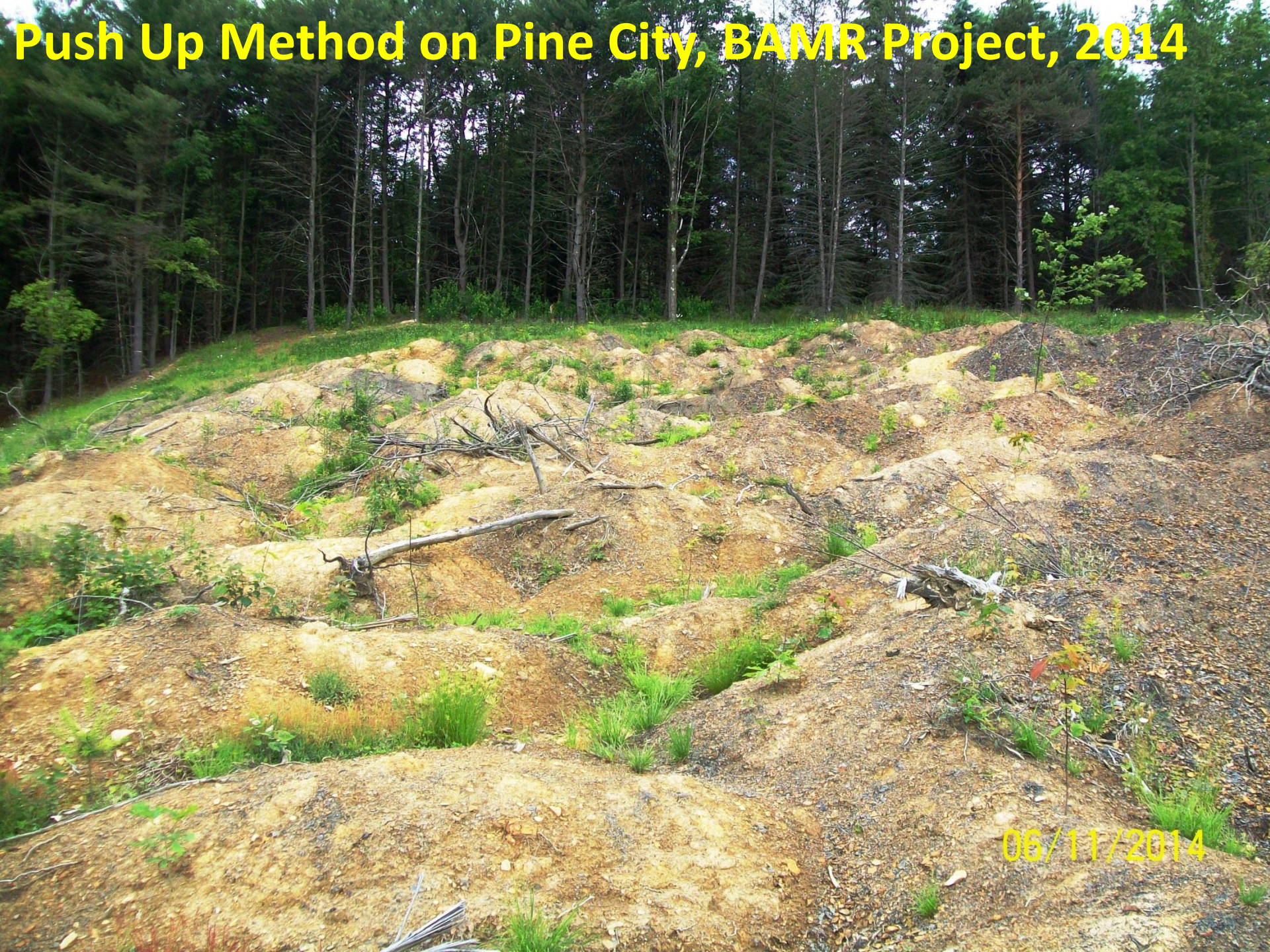
12/07/2012



12/07/2012



12/07/2012



Push Up Method on Pine City, BAMR Project, 2014

06/11/2014

Push up Method on Miola West, BAMR Project, 2014



06/11/2014

National Park Service
U.S. Department of the Interior



Flight 93 National Memorial

04/09/2014



09/02/2011



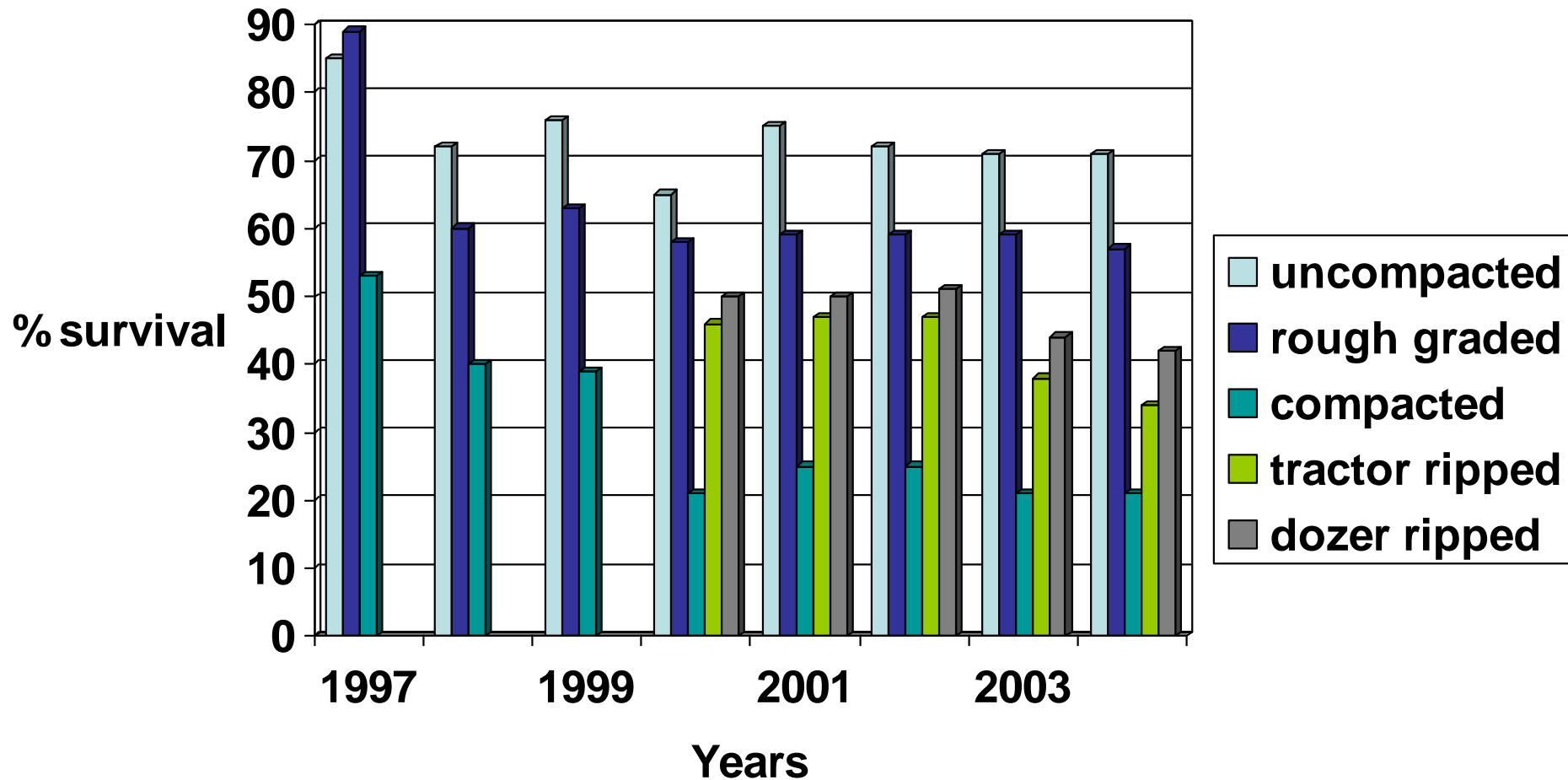
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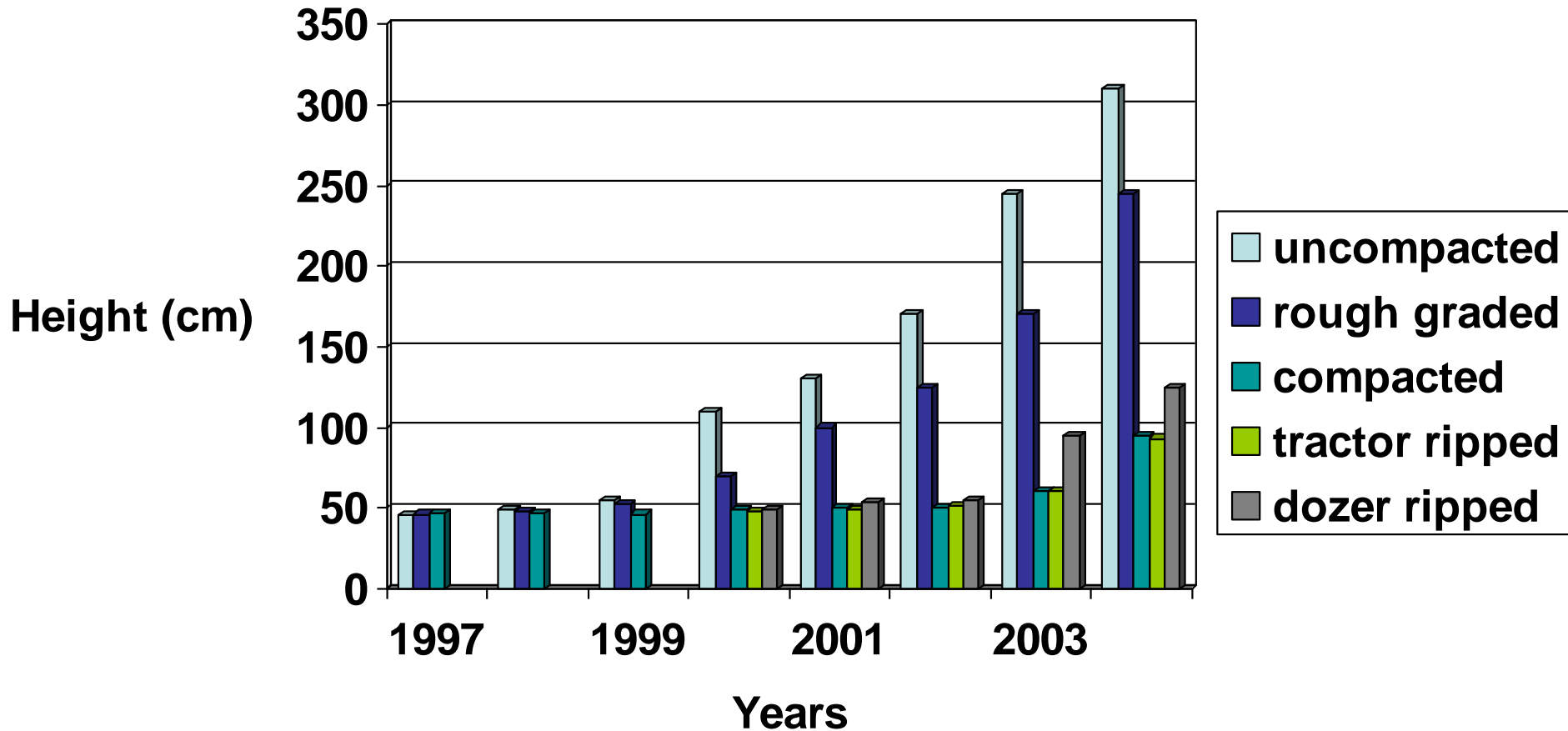
Compaction studies...

- Torbert and Burger (1994) conducted 5-yr study in EKY w/3 treatments:
- Conrad (2002) @ StarFire reported 74% tree survival in loose spoil compared to 25% survival in compacted spoil
- Angel et al. (2006) found even a small amt of traffic (i.e., 1 or 2 passes w/D9) reduce growth in white pine and yellow poplar

Average Tree survival Rate for Different Spoil Conditions Starfire Mine



Average Tree Height for Different Spoil Conditions Starfire Mine



COMPACTED PLOT AT STARFIRE



ROUGH GRADED PLOT AT STARFIRE



END DUMPED PLOT AT STARFIRE.









ROUGHNESS SCALE 1-10























35 year old reclamation with no invasion of native vegetation



04/06/2010



**FOR ADDITIONAL
INFORMATION:**

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