

WHERE DO WE GO FROM HERE?

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Where do we go from here? My answer would be to go forward. Let's keep the momentum going. There is nothing more exciting than an idea whose time has come. I have always felt that any landmark piece of legislation like SMCRA is, that it is a work in progress. We grow in wisdom and understanding of what it can do. Things that were appropriate in the interpretation of SMCRA 20 years ago, may not be as relevant or valid today. I am committed to our being proactive, to changing our way of thinking.

You should look at the list of people attending this forum and look at the diversity and caliber of people in attendance. Think back over how many of the speakers here have noted the tremendous areas of consensus. When we prepare the proceedings for this event, we may find that 90 percent of the comments that have been made are compatible with each other. This moves us a long way on the path that we want to pursue.

Part of our momentum has to be along the lines of education. I have heard over and over speakers telling us that we must educate the landowners. I hope that we can have future events where we can have greater participation by landowners and the public. Ideas like the Tree Bank that we heard from the Nature Conservancy are very exciting. These types of ideas need to be encouraged and acted upon. I hope that we are able to host more conferences of this nature and to hold them in this part of the country where we are centrally located for many of the people concerned about these issues. I hope that we will follow through with developing course work on this subject.

In a very specific way, we are in the process of developing an outreach program on our revegetation success rules. We are looking at the issue of diversity and how it ties into determining revegetation success. One of the concerns is, "What is the effect that our statistical requirements have on the statutory mandate for diversity?" We are initiating an effort to collect this information over the next three months. We want to collect information from all of our stakeholders. We want to know what their thoughts are on our revegetation rules, specifically for diversity, but also on any other related aspects of the rules. We will be distributing a concept paper to all of our stakeholders. Everyone that is registered for this forum will be receiving this mailing. We are planning to hold between four and six public meetings around the country to get input on this issue.

I hope that you will see this philosophy applied throughout our agency in all areas. We need to have an open and inquiring mind and distinguish fact from folklore in our regulatory program. I was interested today to hear that we may have some statements being made concerning what SMCRA requires that only represent one person's point of view, or may be a hand-me-down story that is not true. We will try to get to the bottom of these through training of our instructors and our inspectors.

One of the things that we have to be very careful of is the temptation to layer on new requirements. This is the practice of continually layering on new requirements without weeding out old ones. We will give our rules and regulations a very good review and seek to maximize the flexibility under our current regulatory system. Our operating assumption must be that we can do this within our existing system by changing the way we think about and do things. If we have to consider rule making in order to accomplish our goals, then we will do that, but it will be the last resort.

We need to continue to build a coalition of interest groups. I believe we have a tremendous opportunity to create new alliances for our point of view. We need to show that we are capable of holistic and long-range thinking with very positive environmental benefits, rather than just looking for easier and cheaper ways to do business. As we move forward to the promotion of reforestation, we do not want to slip back into old habits or abuses that prompted the passage of SMCRA. It is so important that we have the participation of industry at this forum. I am encouraged that the head of the National Mining Association will encourage his members to work with us on this issue.

OSM was born in conflict and brought to life in compromise and trade offs that are still bones of contention. Much of our history has been one of long and bitter litigation. It would be a wonderful time of renewal if we could find a common cause in this issue of reforestation and come to agreement without resort to litigation or rule changes. Instead, if we could, by common sense and civility, open communications and be flexible to entertain new ideas, then we could move along on a vision that future generations will thank us for. As one of our speakers said, sustainability really is the debt that our generation owes to the next generation. We need to pass on a land that will hold promise and hope for future generations.

I think the perfect way to end this meeting is to think of the values that we attribute to trees. Since I grew up in Rock Springs, Wyoming, you can appreciate why I would love trees because I never saw many of them. The first acting governor of Wyoming was quoted as saying in his first address to the new state was that “A tree is a shelter from the hot sun and those roaring western winds. The tree roots will go into the ground and hold the water and keep the soil from being blown away. A tree can provide a home for birds and habitat for other wildlife. A tree can grow food to sustain us. They are a source of adornment that can give us pleasure and aesthetic values for wherever we live.” All of this 100 years before we learned that they also sequestered carbon. Trees represent renewal and growth and that is what I hope you take out of this forum.

If you will stick with us and work with us, we are capable of entertaining new common sense ideas. Help us to find any parts of the regulations that you feel stand in the way of successful reforestation where it would otherwise be appropriate. If we can have the kind of give and take, attention, respect, and creativity that I have seen at this forum, I believe we can get this job done.

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1. Assistant Attorney General for Wyoming,
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POSTER PRESENTATIONS

Woody Establishment Patterns Following Mountaintop Removal in the Coal River Valley

Stacy N. Edmonds and Olie L. Loucks, Miami University, Oxford, Ohio

Deep Soil Loosening with Sludge Incorporation Promotes Tree Establishment on Minesoils

Jack Vimmerstedt and D.A. Kost, School of Natural Resources, The Ohio State University, Wooster, Ohio and W.D. Smith, Mead Corporation, Chillicothe, Ohio

Use of Woody Plant Seed to Reforest Mined Land: Purpose, Problems, and Opportunities

Dr. Lawrence T. Beckerle, Glenville State College, Craigsville, West Virginia

Reforestation of Alabama's Abandoned Mine Lands

Dr. E. S. Lyle, Jr. and J. L. Kitson, Walker County Soil & Water Conservation District, Jasper, Alabama

WOODY ESTABLISHMENT PATTERNS FOLLOWING MOUNTAINTOP REMOVAL IN THE COAL RIVER VALLEY

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Abstract

Six postmining restoration sites in the Coal River Valley, West Virginia were selected for study during 1997 and 1998. All sites had been revegetated with herbaceous legumes, grasses, and woody species, and ranged in age from two to twelve years of growth.

The sites were found to be not uniform in character despite the fact that uniformity has been a prevalent assumption in planning reclamation. For example, quite similar seed mixtures or plantings are applied to all conditions at a site; however, the postmining sites were found to be a mosaic of interacting landforms composed of fields, mounds, valley fills, slopes, benches, divergent ditches, and ponds. The purpose of the study was to determine whether repeating vegetation patterns exist for the man-made landforms following large-scale mining operations. The cover of bare ground, herbaceous, and woody species was determined in two meter square quadrats placed mechanically along all transect lines in relation to the man-made landforms. The seven landform types evaluated had statistically significant differences in percent cover for each vegetation type and bare ground (p-value less than 0.0001). Mountaintop removal field and mound landforms supported less than 1 to 2 percent cover in trees and shrubs. The postmining landforms that supported a somewhat higher than average cover of woody species were contour wetland-drainage areas (11 percent), valley fill landforms (10 percent), and highwall elimination slopes (8 percent). Based on this evaluation, reclamation practices can probably be improved by targeting reseeding by landform type and addressing reforestation success in relation to specific landform characteristics.

Introduction

Advances in surface mining technologies in Appalachia have led to the increased use of a large-scale mining form called mountaintop removal. Current mining practices can disturb mountain, forest, and stream systems at a scale of hundreds to thousands of acres. Reclamation of mountaintop removal sites is often more difficult than restoration of conventional contour mines. Modern sites require the revegetation of large man-made drainage systems as well as sloping landforms. This study investigated whether vegetation patterns exist for specific man-made landforms following either of the two types of mining practices, mountaintop removal or contour mining. See Figure 1.

Results I

Mine sites studied showed that none are uniform in character despite the fact that uniformity has been a common assumption in treating postmining sites (e.g., evenly applying similar seed mixtures for an entire site). The reclamation sites were found to be mosaics of interacting landforms. The differences between landform types at a local scale are comprised of specific patterns of terrain characteristics including slope and aspect. The landforms also have distinct physical properties including differences in compaction levels and the composition of soil and parent material.

Results II

Analysis of the data suggests many effects of local landform characteristics on vegetation growth, cover, and composition.

- The four plant communities found (vegetation groups), especially woody plants, showed differences in

abundance in relation to landform types, while being characteristically absent on others.

- Woody vegetation on the reclaimed mine sites was about two times higher on contour mine sites (8 to 11 percent) than on mountaintop mine sites (2 to 6 percent), with a marginally significant difference (p-value = 0.05) (Table 1).
- The seven postmining landform types evaluated had statistically significant differences in percent cover for all vegetation types, with a p-value less than 0.0001, using ANOVA model.
- Box plots (Figure 2 and Figure 3) show individual landform types as having quite different and distinctive biotic communities beginning to be established, but with significant areas of bare ground still remaining on some landforms.
- Within the mountaintop removal field and mound landforms, the cover of trees and shrubs was less than 1 to 2 percent. (See Table 1.)

Discussion and Conclusion

- Woody species accounted for less than 11 percent vegetation cover at any one landform type, indicating low survival of planted trees and shrubs and low occurrence of woody colonization from adjacent forests.
- The mountaintop removal highland mound and field areas have the lowest woody cover of all postmining landforms establishing only ~1 to 2 percent cover. Both types typically have hard compact soils, creating problems for root and shoot growth.

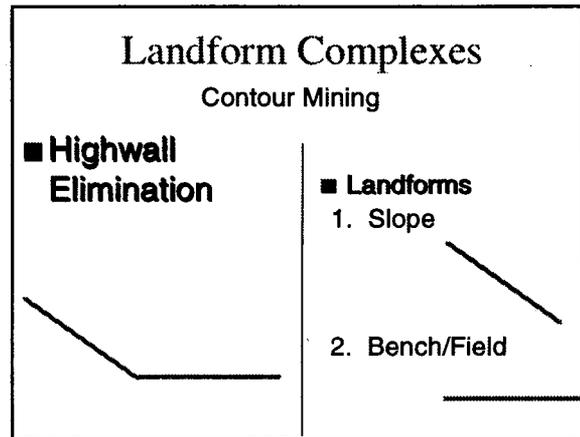
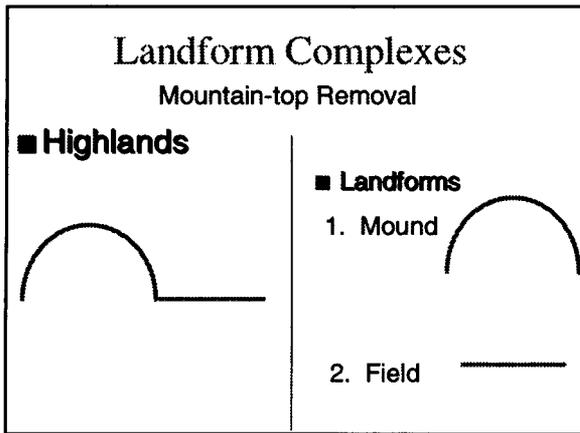
At this point in time, reestablishment of forest on these postmining sites appears questionable. Neither mountaintop removal sites nor the contour mines support a vegetation composition or structure that is likely to resemble regional forests.

Based on this study, mine reclamation might be enhanced by targeting specific landform types with specific seeding or planting practices and addressing reforestation in relation to specific landform characteristics. Future research needs to investigate the success of vegetation associated with landform characteristics, including soil physical properties, geochemistry of drainage water, and detention export rates of water and nutrients.

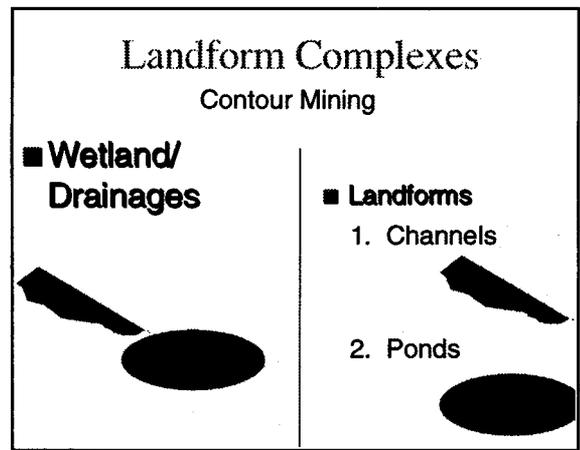
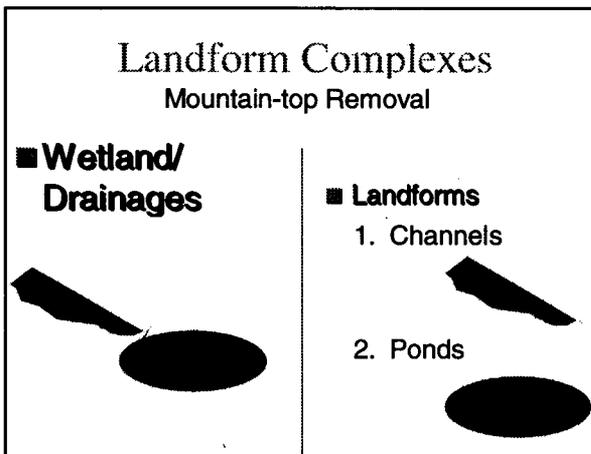
Figure 1. Five surface mine landform complexes of the Coal River Valley region.

Mountaintop Removal Mine Landforms

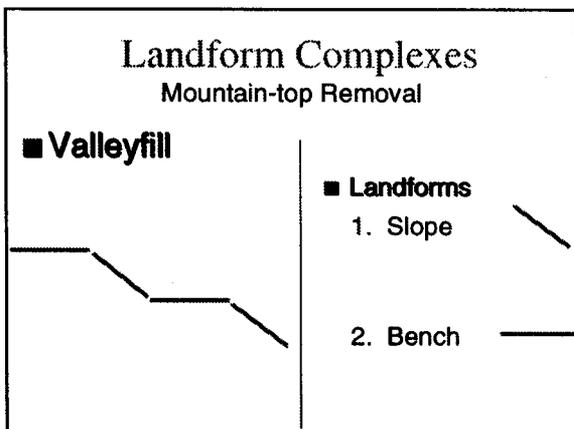
Contour Mine Landforms



a. Post-mining landform structures found at primary site of mining activities



b. Network of man-made waterways and the associated landform structures.

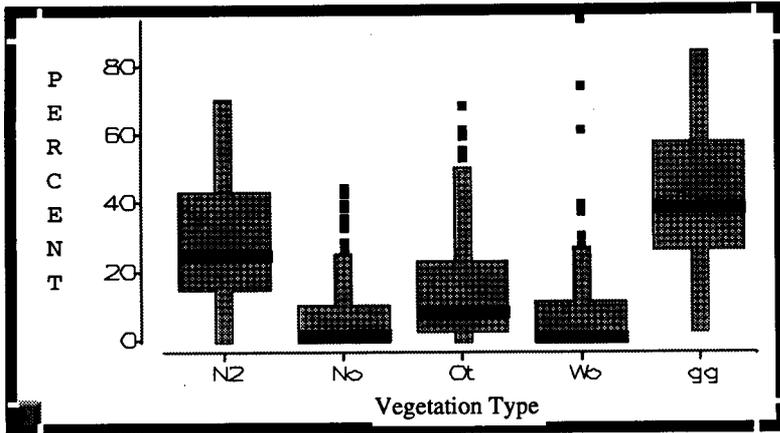


c. Overburden disposal areas located at the head of valley and stream systems.

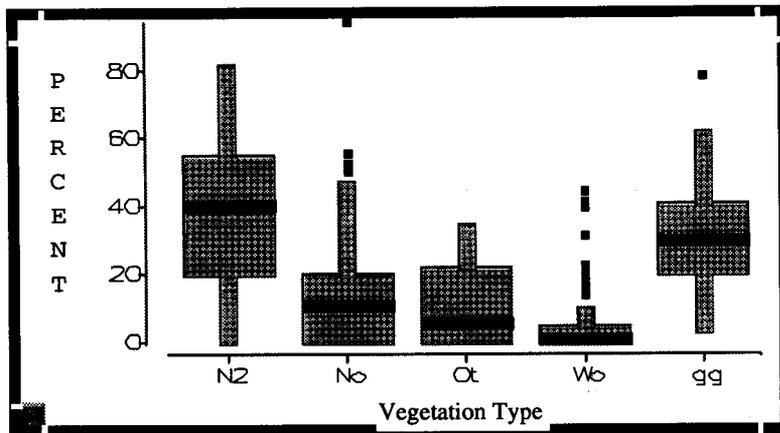
Figure 1. Five surface mine landform complexes of the Coal River Valley region.

Table 1. Mean cover and standard error from ANOVA tests, assume significance level at $\alpha=0.05$ for vegetation types sampled on specified mine landforms. Raw mean scores are presented. Means with the same lowercase superscript letter in the same column are not significantly different.

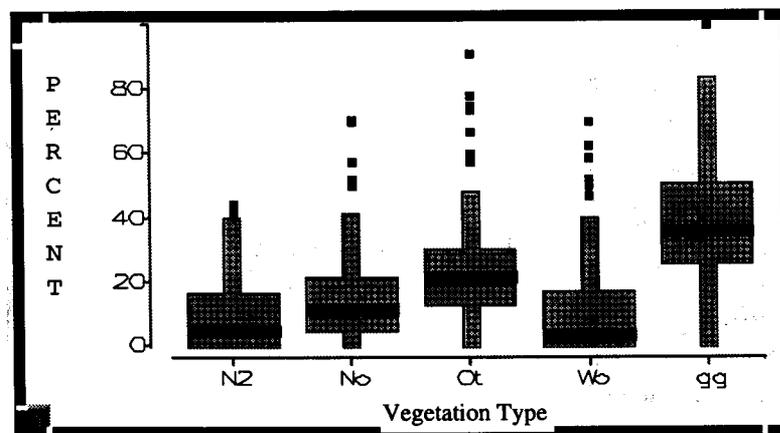
Mine Landforms		Mean Percent Cover \pm Standard Deviation				
		Grasses	N2-Herbs	Forbs	Woody	Bare
Mountaintop removal						
Highland Complex						
1. field	n=45	60.4 \pm 18.1 ^a	24.3 \pm 15.6 ^a	1.7 \pm 5.8 ^a	2.0 \pm 8.4 ^{abc}	11.6 \pm 24.3 ^{ab}
2. mound	n=75	51.7 \pm 20.8 ^b	39.9 \pm 19.8 ^b	1.5 \pm 5.5 ^a	0.4 \pm 2.2 ^{abc}	6.5 \pm 9.5 ^{ab}
Valley fill Complex						
3. slope/ bench	n=60	40.9 \pm 20.4 ^c	38.8 \pm 24.2 ^b	1.9 \pm 7.2 ^a	10.8 \pm 19.7 ^d	7.7 \pm 15.1 ^{ab}
Wetland Drainage Complex						
4. channels, drainages & ponds	n=90	46.8 \pm 23.0 ^b	21.7 \pm 22.3 ^c	13.6 \pm 19.9 ^b	6.6 \pm 13.4 ^d	11.3 \pm 16.1 ^{bc}
Conventional Contour						
Highwall Elimination Complex						
1. highwall slope	n=105	41.5 \pm 21.2 ^c	27.5 \pm 17.7 ^a	15.8 \pm 17.6 ^c	8.0 \pm 15.4 ^d	7.4 \pm 11.1 ^{ab}
2. highwall bench	n=75	31.4 \pm 15.1 ^d	38.9 \pm 20.7 ^b	10.5 \pm 11.0 ^b	5.3 \pm 10.5 ^{bcd}	14.5 \pm 17.9 ^c
Wetland Drainage Complex						
3. channels & ponds	n=90	38.0 \pm 19.8 ^c	10.3 \pm 12.7 ^d	24.7 \pm 18.7 ^d	11.4 \pm 16.1 ^d	15.5 \pm 14.9 ^c



a. Revegetated highwall slope landforms.

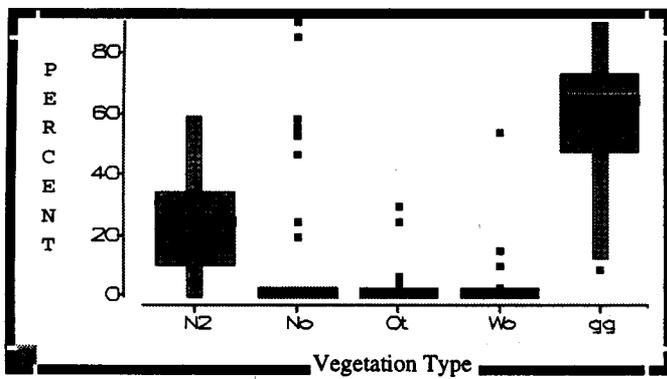


b. Revegetated bench landforms.

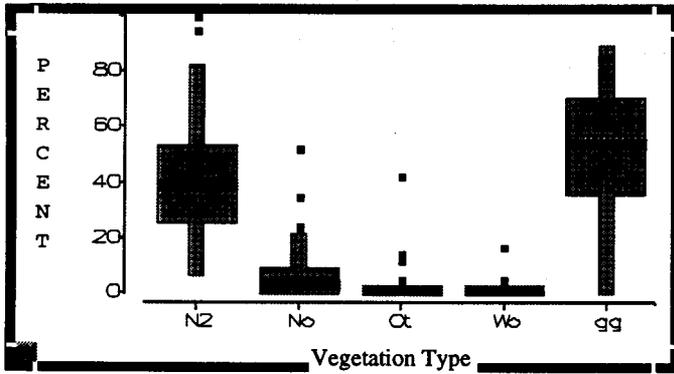


c. Revegetated contour wetland-drainage landforms.

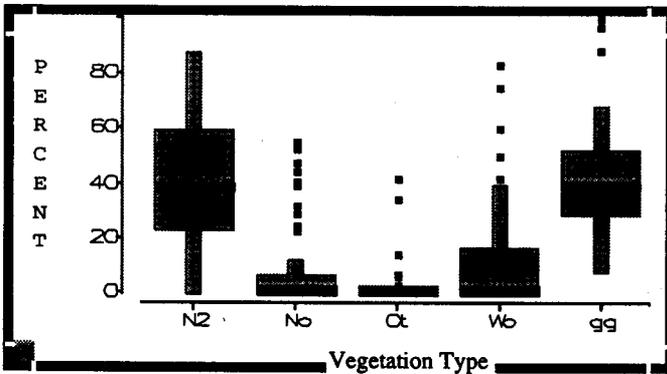
Figure 2. Boxplots of vegetation types responding to contour mine landforms: N2 is nitrogen-fixing herbs; No is bare ground; Ot is forbs; Wb is woody; and gg is grasses.



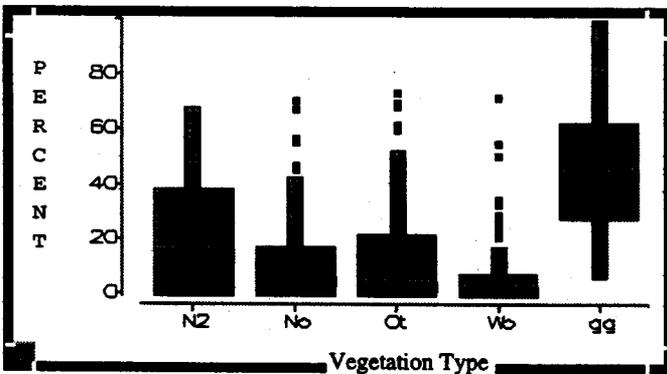
a. Revegetated highland field landforms.



b. Revegetated highland mound landforms.



c. Revegetated valleyfill landforms.



d. Revegetated mountaintop wetland-drainage landforms.

Figure 3. Boxplots of vegetation types responding to mountaintop removal landforms: N2 is nitrogen-fixing herbs; No is bare ground; Ot is forbs; Wb is Woody; and gg is grasses.

DEEP SOIL LOOSENING WITH SLUDGE INCORPORATION PROMOTES TREE ESTABLISHMENT ON MINE SOILS

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Abstract

We measured survival and height growth of white ash (*Fraxinus americana* L.), sycamore (*Platanus occidentalis* L.), and black walnut (*Juglans nigra* L.) on a regraded acid typic udorthent of pH 2.9, and of white ash on a calcareous typic udorthent of pH 6.5-7.5. The acid mine soil had been treated with paper mill sludge incorporated by rototilling 15 cm (860 Mg of sludge per hectare) to 30 cm depth, shallow backhoeing 15 cm of sludge to 90 cm depth, or deep backhoeing 60 cm (3450 Mg per hectare) to 150 cm depth. The calcareous mine soil was either graded grey cast overburden or "topsoil" graded over graded grey cast overburden, the current standard reclamation system. After five growing seasons on the acid mine soil, comparing shallow backhoeing versus (vs) deep backhoeing vs rototilling treatments, survival was 39 percent vs 30 percent vs 17 percent for black walnut; 38 percent vs 47 percent vs 11 percent for sycamore; and 58 percent vs 58 percent vs 38 percent for white ash. Total heights, shallow backhoeing vs deep backhoeing vs rototilling, were (cm) 140 vs 148 vs 74 for black walnut; 481 vs 431 vs 144 for sycamore; and 211 vs 188 vs 112 for white ash. After five growing seasons on the calcareous mine soil, white ash survived well (98 percent), but heights were only 102 cm on topsoil and 94 cm on graded overburden. On the acid mine soil, we attribute the significantly better survival and height growth of trees on backhoe treatments to creation of a larger volume of soil with low bulk density and better ability to supply water, air, and nutrients. We attribute the comparatively slow growth of white ash on calcareous mine soil to absence of a sufficient soil volume with favorable water, air, and nutrient supply for root growth.

USE OF WOODY PLANT SEED TO REFOREST MINED LAND: PURPOSE, PROBLEMS, AND OPPORTUNITIES

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Abstract

Prior to the Surface Mining Control and Reclamation Act (SMCRA), a University of Auburn study found trees in Alabama to be growing 50 percent faster on mined land than on undisturbed land. Not only was reforestation of mined land productive, it could be inexpensive. Application of seed and fertilizer by aircraft at the rates of 0.5 pounds of loblolly pine, 5 pounds of kobe lespedeza, and 10 pounds of fertilizer to the acre was all that was needed to reforest regraded and partially terraced rock overburden in the Warrior coal basin. Earlier plantings using conventional methods by the same author were less successful even though mulch was applied and fertilizer rates were more favorable.

Reforestation attempts following SMCRA have not been as productive as similar attempts on undisturbed lands. Many scientific papers have been written about the effects of excessive compaction and increased vegetative competition with trees on lands reclaimed after the passage of SMCRA. Relatively few scientific papers have addressed the effect of reduced water availability for tree growth due to the effects of increased compaction and vegetative competition found on mines reclaimed after SMCRA.

On mined lands reclaimed after SMCRA, the adverse effects of water infiltration and ground water recharge can be overcome, in part, by construction of absorption terraces and other water conservation techniques. Part of the challenge with growing trees is finding ways to help trees outcompete existing grasses for light, nutrients, and especially moisture. Where economically available, sawdust and other wood industry by-products can help reduce competition and increase moisture availability. If these materials are not available, it is most important to find ways to facilitate the maximum genetic potential for taproot development. Planting trees by seed rather than seedlings avoids damage to the taproot through pruning. The adverse effects of compaction that reduce water infiltration also could be partially mitigated by the use of "green manure" cropping. On gentle slopes and/or where the potential effects of erosion are minimal, the use of annuals that would reseed themselves would greatly reduce the competition with trees in terms of top growth and root competition. The use of relay cropping techniques and some native species also would facilitate a more diverse tree cover. It is the author's observation that there has been a bias against absorption based soil and water conservation techniques as a result of:

- the lack of a clear interpretation of requirements for approximate original contour;
- the requirement to replace topsoil;
- the interim OSM regulation prohibiting depressions bigger than a square meter; and
- state regulations prohibiting depressions deeper than 0.2 feet where there is a probable flow of water.

REFORESTING ALABAMA'S ABANDONED MINE LANDS

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Introduction

Approximately 95 percent of coal surface mining land in Alabama was once forested. While the amount of land disturbed by surface mining is not great when the entire state is considered, the amount disturbed within some districts is substantial. Though site stabilization is the primary goal, it seems reasonable to assume that these mined areas will be returned to forest production for the good of state and local economies. Also, tree cover provides excellent wildlife habitat. With this in mind, in 1987 the Alabama Abandoned Mine Land Reclamation Program embarked on a program to reforest, to the extent possible, all of its AML reclamation projects.

Three problems had to be overcome in order to have successful plantings. These are competition from grasses and legumes, soil compaction, and extreme rockiness. Competition and compaction are always present and rockiness is common on many sites. Previous research in Alabama and other states had shown that competition must be controlled and compaction lessened in order to encourage tree seedling survival and growth. Rockiness interferes with the tree planting process and has to be overcome in order to speed the planting and obtain correct seedling placement.

Methods

In response to these problems, a bulldozer was equipped with a single-tooth ripper and a herbicide sprayer. In October of each year, this equipment is used to rip and spray all areas that are to be planted with tree seedlings in January and February of the following year. Ripping is done to a depth of approximately 14 inches and a 2-foot swath is sprayed on each side of the ripped line with a herbicide solution. The herbicide reduces vegetative competition to an acceptable level, and ripping reduces soil compaction, as well as moving rocks away from the planting area. This movement of rocks allows the planter to place the seedling roots at an acceptable depth. A 55-gallon mixture of 2.5 gallons of Roundup Pro, 10 ounces of Oust, and water is sprayed over 2.5 acres of the 4-foot swath. Spacing between rips is nominally 10 feet. Therefore, $6\frac{1}{4}$ acres can be treated with 55 gallons of solution.

Tree planting starts the first of January. Several different species have been planted over a 12-year period, with loblolly pine, autumn olive, bicolor lespedeza, and sawtooth oak the most used. Approximately 85 percent of the planting is loblolly pine. Loblolly pine is planted for commercial production and other species for wildlife food and shelter. Practically all planting stock is bare root. Seedlings are stored at approximately 40°F until needed. All species are planted on an intended 6 foot by 10 foot spacing, for a total of approximately 725 seedlings per acre. Whenever possible, a tree planting machine is used. One man follows the machine and corrects any planting mistakes such as poorly planted seedlings and unplanted areas. Hand-planting is used where the planting machine cannot function. Constant care is taken to ensure that the seedlings are not exposed to freezing, heating, or drying. Also, supervisory personnel examine each day's plantings to make certain that seedlings are handled and planted properly. This attention to quality control is critical.

Approximately 173 different areas have been planted since 1987 covering a total of approximately 2,731 acres. Areas are not ripped or sprayed when competition is not great or rockiness is not a problem. The average cost of ripping, spraying, and planting is \$231.31 per acre. The range for this cost is from \$200.08 per acre to \$275.73 per acre, depending on size of tracts, equipment breakdowns, overtime pay, and amount of travel.

Results

Twenty-seven plantings were recently chosen at random from the one hundred thirty-nine plantings that were ripped and sprayed from 1987 to 1997. Three plots of 0.01 acre size were chosen at random in each of the plantings. The actual planting spacing, number of surviving seedlings, total height, and D.B.H. were determined for each plot. (See Table 1).

Overall survival is 86.1 percent for the eleven years in which tree planting with ripping and spraying has been performed. The range in survival is from 77.0 percent to 99.7 percent. The one to eight year old stands have a survival of 87.4 percent and the nine to eleven year old stands have an average survival of 81.0 percent. This indicates that survival is decreasing, but not at an unacceptable rate.

It is too early in the stand development to determine productivity; however, site index at age 25 will be approximately 60 feet if height growth follows the Coile and Schumacher site index equation for loblolly pines in the Piedmont region.

Historically, much of the tree planting on reclaimed coal surface mines has been unsuccessful. Some of the causal factors have been addressed in this report. Other factors such as species, topography, type of mine soil, and climate may need to be evaluated when establishing tree planting programs in other states. The basic mechanics employed in Alabama's AML Program are worth consideration.

TABLE 1 - PLOT MEASUREMENT RESULTS

Planting Site	County	Year Planted	Avg. # Surviving Seedlings Per Acre	Avg. # Seedlings Planted Per Acre	Survival %	Avg. Height Feet	Avg. D.B.H. Inches	Dom & Codom Height Feet	Stand Age Years
Herman Church	Walker	1989	633	723	87.6	28.4	5.5	31.2	10
Grace Chapel	Walker	1989	700	798	87.7	28.0	6.1	28.0	10
Quarry Landing	Tuscaloosa	1989	533	663	80.4	27.0	5.4	30.1	10
Gayosa	Walker	1988	667	864	77.2	28.0	5.9	28.0	11
N. Alabama Junction	Tuscaloosa	1990	600	737	81.4	26.8	4.6	30.8	10
Peques Creek	Tuscaloosa	1990	533	666	80.0	25.7	5.3	28.4	9
Meadow Creek	Winston	1988	600	825	72.7	26.7	6.7	35.3	11
Lilly Chapel	Blount	1992	567	747	75.9	21.4	4.2	24.0	7
Kimberly N. Emer.	Jefferson	1992	667	716	93.2	9.6	1.4	11.1	7
Fairview	St. Clair	1996	900	937	96.1	7.9	1.0	10.0	3
Copeland Bend	Walker	1993	867	871	99.5	19.2	3.4	22.4	6
Allman Road	Jefferson	1993	700	842	83.1	10.7	1.7	13.0	6
Lawsontown	Jefferson	1992	767	871	88.1	23.9	4.4	25.2	7
Charlie's Creek	Walker	1993	667	682	97.8	13.5	2.5	16.3	6
Oak Grove School	Walker	1997	1000	1031	96.7	2.3	-	2.9	2
Brookside Church	Walker	1997	1000	1048	95.4	3.2	-	3.9	2
Little Black-water	Walker	1994	733	834	97.9	13.2	2.5	15.7	5
Bankhead Forest	Winston	1996	767	918	83.6	4.3	-	5.4	.3
Panter	Fayette	1993	733	913	803.3	4.4	2.5	16.9	6
Pendley Chapel N.	Fayette	1993	900	903	99.7	18.5	3.4	20.6	6
McCollum West	Walker	1992	600	691	86.8	23.0	4.7	24.8	7
Burnwell	Walker	1992	600	6391	86.8	23.0	4.7	24.8	7
Spelunker Hollow	Walker	1995	766	871	87.9	8.8	-	10.3	4
Praco	Jefferson	1996	600	8456	71.0	7.1	0.5	9.1	3
Camp Cherry Austin	Tuscaloosa	1998	533	644	83.1	1.0	-	1.2	1
Tanyard Creek	Winston	1993	700	980	72.2	12.0	2.2	14.8	6
Wallace Drive W.	Cullman	1995	667	716	93.2	5.2	-	6.1	4
Averages			701	816	86.1				

Standard deviation for survival is 19.22.

Standard error of the mean is 3.32.

Confidence interval (t 0.05) is 92.62% to 78.98%.

Confidence interval (t 0.01) is 94.99% to 76.57%.

Compilation of the above data was completed on March 16, 1999.

SURVEY RESULTS

REFORESTATION TECHNICAL INTERACTIVE FORUM PARTICIPANT COMMENTS AND RECOMMENDATIONS

OVERALL VALUE OF FORUM

	TOTAL RESPONDENTS	PERCENTAGE
EXCELLENT	36	55
GOOD	24	36
FAIR	5	8
POOR	0	0

COMMENTS ON VALUE OF FORUM:

COMPLIMENTS

- I appreciate OSM's effort in discussing the reforestation issue. The steering committee did a great job in getting together this mix of stakeholders and planning the forum. I am confident that this balanced approach will work to the benefit of the environment. I applaud OSM's Director Karpan for supporting this initiative.
This program is an encouraging example of how all phases of the mining process can work together (i.e., regulatory community, research, operators, conservation, and environmental community.)
- Concept of interactive forums is very good. OSM should be commended for scheduling an interactive forum on reforestation; the need to get more mined land which was originally forested returned to forest land deserves the attention.
A very good forum that was long overdue.
- Fabulous cross-section of speakers and topics. Best technical seminar I have been to in years.
- The forum was well put together and very useful.
- Overall an excellent program.
- I obtained a wealth of information. Extremely impressed with the presentations and the overall quality.
- I found the talks interesting, educational, and informative; glad I attended.
- Very valuable, informative, and enjoyable.
- I hope that this type of forum will continue.
- Having the diversity of speakers made this forum worthwhile.
- Well received, important issues where OSM needs to take the lead on implementation.

SUGGESTIONS

- Lots of good suggestions but getting them implemented may be another story.
- We need to build on the common theme that "Forests are good and we need to encourage them."
- I applaud OSM for taking the initiative to address this topic; hopefully, we can now work toward a common goal.
- This program is not only "politically correct," it is actually "really correct" in terms of scientific backup and common sense observations. Let's take this opportunity and momentum to get implementation in all coal states. We need some localized seminars to take this to the state regulatory staffs and field inspectors.

TOTAL REGISTRATION

	<u>REGISTRANTS</u>	<u>PERCENTAGE</u>
TOTAL:	160	100

AFFILIATION

OSM	43	27
STATE	43	27
INDUSTRY	28	18
F&W/FOREST	15	9
UNIVERSITY	14	9
CONSULTANT	11	7
CITIZEN	4	3
US ARMY CORP OF ENG.	1	1
US DOE	1	1

REGIONAL REPRESENTATION

	#	%
APPALACHIAN	90	56
MID-CONTINENT	59	37
WEST	11	7

PARTICIPANTS FROM THE FOLLOWING STATES (28)

AL	IL	MS	PA
AR	IN	MT	TN
AZ	KY	NC	TX
CA	LA	NJ	UT
CO	MD	NY	VA
DC	MN	OH	WA
GA	MO	OK	WV

PARTICIPANTS WHO COMPLETED THE SURVEYS

	<u>NUMBER</u>	<u>PERCENTAGE</u>
TOTAL RECEIVED	70	100
AFFILIATION		
State:	27	39
Federal:	19	28
University:	5	7
Industry:	13	19
Public:		0
Consultant:	4	6

USEFULNESS OF TALKS

1=EXCELLENT; 2=GOOD; 3=FAIR; 4=POOR

SESSION 1 STATUS OF OSM/STATE EFFORTS

<u>PRESENTER</u>	<u>AVERAGE RATING</u>	<u>RATING RANGE</u>
Sponsler	1.5	1-4
Long	2.2	1-4
Boyce	2.2	1-4

SESSION 2 INTEREST GROUP PERSPECTIVES

<u>PRESENTER</u>	<u>AVERAGE RATING</u>	<u>RATING RANGE</u>
Sponsler	1.9	1-4
Long	2.1	1-4
Finkenbinder	2.2	1-4
Strange	2.8	1-4
Burger	1.4	1-4
Beam	2.1	1-4
Stafford	1.9	1-4
Probert	1.9	1-4
Morton	2.1	1-4

SESSION 3 STATUS OF TECHNOLOGY

<u>PRESENTER</u>	<u>AVERAGE RATING</u>	<u>RATING RANGE</u>
Burger	1.5	1-4
Ashby	1.9	1-4
Graves	2.2	1-4
Sweigard	2.3	1-4

SESSION 4 PRACTICAL APPLICATIONS IN RECLAMATION

<u>PRESENTER</u>	<u>AVERAGE RATING</u>	<u>RATING RANGE</u>
Waugh	1.9	1-4
Ballek	1.8	1-4
Pfannenstiel	1.9	1-4
Stroud	1.8	1-4
Walker	1.9	1-4
Miller	1.5	1-4
Liebering	1.9	1-4
Kastor	1.8	1-4
Cordell	1.9	1-4
Williamson	2.4	1-4
Probert	2.2	1-4

SESSION 5 INTEREST GROUP RECOMMENDATIONS

<u>PRESENTER</u>	<u>AVERAGE RATING</u>	<u>RATING RANGE</u>
Sponsler	1.9	1-4
Daniels	2.2	1-4
Finkenbinder	2.2	1-4
Davis	2.1	1-4
Burger	1.5	1-4
Beam	1.9	1-4
Stafford	2.0	1-4
Probert	1.9	1-4
Morton	2.2	1-4

COMMENTS ON USEFULNESS OF TALKS

COMPLIMENTS

- Good range and representation of speakers.
- Very knowledgeable group of speakers.
- Indiana speaker gave me the specific information I needed for planting on soil not spoil, best herbicides, and how to get the most out of my tree planting.
- Good wildlife perspective.
- Good topics and information. I liked the practical applications that can be incorporated into our own program.
- Excellent information transfer.
- Numerous speakers with very good credentials.

NEED FOR IMPROVEMENT

- Some of the speakers generalized too much and lost credibility.
- Speakers should not have been allowed to exceed their time.
- Chairpersons should have kept speakers on time. Many ran over way too long.
- Too many talks, days too long, need longer breaks.
- Some topics were redundant.
- Speaker on effects of compaction used technical terms I was unfamiliar with.
- The speaker representing the eastern states was not representative of many eastern state concerns.
- Some speakers could not separate their science facts from their own opinions.
- Not enough time for participant discussions.
- Speakers had more information than could be presented in the allotted 15 minutes.

SUGGESTIONS

- We all seem to want the same thing. The states need to be more forestry user friendly and allow more options for planting trees.
- Hopefully this will begin a new OSM/State initiative on forest restoration on active mines and abandoned mine lands.
- The best thing was that the issue of the use of spoil as soil was brought out in the open and discussed.
- We all seem to know what the issues are, now it is time to act.
- I am in favor of planting trees on reclaimed land but not at the expense of returning to the less restrictive environmental protections prior to SMCRA.
- Need to make tree planting more user friendly. Productivity formulas for bond release will be very counterproductive to increased forestry land use.
- May need to involve staff from university extension service and the NRCS to achieve a “grass-roots” education for landowners to get on-board with new reforestation practices.

TOPICS OR SPEAKERS THAT PARTICIPANTS FELT SHOULD HAVE BEEN INCLUDED AT THE FORUM

- The state and federal inspector point of view should have been developed better.
- Willis Vogel.
- Lawrence Beckerle.
- Needed the dozer operator point of view.
- Needed more information on wetland mitigation.
- How this is being handled in industry.
- Needed to have a geologist to relate overburden chemistry to potential for tree rooting material.
- Needed more representation from the tree planting industry and fewer university presenters.
- More state regulators and industry.
- Acid spoils, natural succession, and ecosystem function needed to be better addressed.
- Need to educate land owners in the land use process.
- Environmental law specialist and citizen environmental group.

- How states can create positive incentives for reforestation on mined land.
- Wildlife use of forests.
- More information on how reduced grading can reduce soil compaction.
- Need to discuss the use of willow cuttings to make living stream banks to control erosion.
- Large paper and timber companies have been able to provide helpful experience.
- Potential for enhanced biodiversity.
- More on AML reforestation efforts.
- Effects of tree planting related to requirements to restore the post mining land use.
- Small private landowners should have been included.
- Some of the repetitive talks could have been eliminated.
- Representative from the University of Tennessee.

HOW DID YOU LEARN ABOUT THE FORUM?

US MAIL	24	34
E-MAIL	11	16
OSM WEBSITE	12	17
WORD OF MOUTH	36	51
PERIODICAL	2	3
NEWSPAPER	0	0

QUALITY OF MEETING FACILITY

	TOTAL RESPONDENTS	PERCENTAGE
EXCELLENT	21	35
GOOD	33	55
FAIR	6	10
POOR	0	0

COMMENTS ON FACILITY

COMPLIMENTS

- Very friendly and accommodating, good location.
- Nice facility.
- Meeting room comfortable, spatial distribution, and setting very good.
- They did a good job accommodating individual problems.
- Nice facility, easy access, plenty to do close by.
- The person in charge of audio recording was super.

NEED FOR IMPROVEMENT

- The lighting for slides could have been better.
- Too cold the first day was a common complaint that was not rectified.
- Confusion over room rates were common.
- Lexington, Kentucky, would have been more centrally located.

- Meeting room could have been cleaner.
- Supplies for midmorning break first day were delivered much too late.
- Pencils and pads missing first day.
- No message board.
- Very poor lighting over registration area.

APPENDIX 1: RECORDED DISCUSSIONS

Edited by Kimery C. Vories
USDI Office of Surface Mining
Alton, Illinois

The following are the edited discussions that took place at the end of each speaker presentation and at the end of each topic session. The actual comments have been edited to translate the verbal discussion into a format that more effectively and efficiently communicates the information exchange into a written format. The organization of the discussion follows the same progression as that which took place at the forum. A topical outline has been developed to aid in accessing the information brought out in the discussions.

Outline of Discussion Topics

Session 1: Status of OSM/State Reforestation Efforts

1. State Statistics on Eastern U.S. Tree Planting Efforts
 - **Acres permitted versus acres planted to trees**
 - **Pre-SMCRA lands reclaimed to forestry**
 - **Resistance to tree planting in Illinois**
 - **Wildlife habitat as forest land**
 - **Wildlife habitat and forest land use**
2. State Statistics on Western U.S. Tree Planting Efforts
 - **Landowner preferences for revegetation**
3. OSM Revegetation Team Survey Results
 - **Government agency coordination**
 - **Required number of trees to plant per acre**

Session 2: Interest Group Perspectives on Constraints, Experiences, Trends, and Needs

1. Eastern State Perspectives on Tree Reclamation
 - **Fragipan soils in southern Illinois**
2. Reforestation in the Western States
3. Impediments to Reforestation: Who Owns the Problem?
 - **Consensus building**
 - **Regulatory predictability**
4. Field Inspector/Historic View of Mine Reforestation in Tennessee
 - **Plant succession based on width of mining cut**
5. Academic Research Perspective on Experiences, Trends, Constraints, and Needs Related to Reforestation of Mined Land
 - **Overburden handling for forest soils**
 - **Soil characteristics for good forest soils**
6. Perspectives Relating to the Establishment of Quality Wildlife Habitat on Mine Lands in Kentucky
7. Ohio's Perspective: A Practitioner's View
8. Reforestation: A Landowner's Perspective
9. Wildlife Perspectives in Reclamation

Session 3: Status of Reforestation Technology

1. Status of Reforestation Technology: The Appalachian Region
 - **Relative acidity with sandstone substrate**
2. Status of Reforestation Technology and Science in Southern Illinois
 - **Site index**
 - **Planting methods**
3. Status of Reforestation Technology in Kentucky

4. Use of Field Compaction Measurement to Predict Reforestation Success

Session 4: Case Studies of Reforestation in Mining Reclamation/Success and Failure

1. Pacific Northwest
 - **Soil handling and revegetation methods**
2. Montana: Site Adapted Container Grown Woody Plants for Mine Reclamation
3. Arid and Semiarid West
 - **Importance of small native pollinators**
 - **Native nitrogen fixers**
 - **Shrub transplants**
 - **Surface rock application**
4. Texas Utilities Commitment to Reforestation
 - **Regulatory restrictions on soil handling plans**
5. Successful Forestry Reclamation in Louisiana/Mississippi
6. Successful Tree Planting Techniques for Drastically Disturbed Lands: A Case Study of the Propagation and Planting of Container Grown Oak and Nut Trees in Missouri
 - **Germination inhibitors**
 - **Reforestation of AML sites**
7. Illinois/Indiana
8. American Electric Power Company Reforestation History on Reclaimed Mine Lands
9. Mycorrhizal Fungi and Trees: A Successful Reforestation Alternative for Mine Land Reclamation
10. Kentucky Reforestation Case Study
11. Forest Productivity of Reclaimed Mined Land: A Landowner's Perspective

Session 5: Interest Group Recommendations to Enhance Reforestation

1. Eastern States Recommendations
 - **Opportunities for improvement of soils**
2. Enhancement of Reforestation at Western Surface Coal Mines
3. Coal Industry Recommendations
4. Field Inspector Recommendations
5. Academic Research
 - **Erosion control and site indices**
 - **Invasive species and biodiversity**
 - **Landowner acceptance of soil substitutes**
 - **Site index development**
 - **Tree productivity and bond release**
6. Kentucky Fish and Wildlife Resources Department
 - **Creating water and wetlands**
 - **Edge species**
 - **Endangered species**
 - **Spoil settlement**
7. Ohio Division of Forestry
8. Landowner
9. Kentucky Chapter/The Wildlife Society
 - **Removal of sediment ponds**

Interactive Panel Discussion

- **Livestock for rodent control**
- **Pond design**
- **Research for forest friendly herbicides**
- **The value of topsoil**

Discussion by Session

Session 1: Status of OSM/State Reforestation Efforts

1. State Statistics on Eastern U.S. Tree Planting Efforts Mike Sponsler, Indiana Division of Reclamation, Jasonville, Indiana

Academic Question (Wildlife habitat and forest land use): In the Appalachian region, it is important to separate the wildlife habitat from forest land. The wildlife habitat is primarily grasses and legumes with some shrubs in Appalachia and would not fit the definition of forest lands. In almost all of the Appalachian states less than half of the land that is mined is returned to forest. The land that is reflected in your statistics as being forest land is actually wildlife habitat that would not meet the definition of forest land.

Answer: The survey was not able to make that type of distinction. If the state did not distinguish between wildlife habitat and forestry in reporting to this survey, there is no way to check it. In the mid-continent states, the primarily use of lands planted to trees is wildlife habitat but then most forested areas in the mid-continent states were not in commercial forestry prior to mining.

Industry Question (Pre-SMCRA lands reclaimed to forestry): In Indiana we have a large area of pre-SMCRA cast overburden sites that are dedicated to forestry. Are these areas, or others that are developing through natural plant succession to forestry, included in your statistics?

Answer: No.

Academic Question (Resistance to tree planting in Illinois): Recently, a small mine in southern Illinois requested that they leave the whole mine in trees, and they were told by the state that they could not do it. At another mine they tried to leave 400 acres in trees and were not allowed to do that either. Is there any way that requests like this can be approved?

Answer: I assume you are referring to the desire of local soil and water conservation districts to return land to agricultural land uses rather than to trees. If the site included prime farmland, then SMCRA precludes such land use changes. If the land is high capability cropland, then there is a lot more flexibility in land use changes.

Academic Question (Acres permitted versus acres planted to trees): Less than one percent of the acreage permitted as forest land use in Illinois has achieved final bond release. Does anyone know what the difference is between the number of acres that are permitted as forest land use and how many acres are actually being reclaimed to a viable forest land use?

Answer: The numbers for Illinois are permitted acres. I really don't know what the bond release situation is.

Academic Question (Wildlife habitat as forest land): It is my understanding that the wildlife habitat includes just about any combination of species that is not forest. This would include any herbaceous species, wetlands, etc. Should wildlife habitat be counted under the definition of forest land in the mid-continent states?

Answer: It is true that wildlife habitat can include other things such as wetlands, warm season grasses, or prairie grasses. Historically about two thirds of Illinois and Indiana were tall grass prairies prior to settlement although there has not been a very large effort on reclaimed areas to return them to prairie grasses. Because of this I felt safe in including the wildlife habitat numbers in with the forested land use although there would be a small percentage of prairie grass and wetland areas included.

2. State Statistics on Western U.S. Tree Planting Efforts Michael Long, Colorado Division of Minerals and Geology, Denver, Colorado

Academic Question (Landowner preferences for revegetation): You keep talking about landowner dislike of

trees. Don't the coal companies have a say in what will be planted?

Answer: Yes. Landownership in the West is a mixture of ownership patterns, leased land, coal company owned, and federal land. Problems are usually on leased land where it is the federal manager or the private landowner who has the final say on land use issues. In this situation, the company may be willing to go along with the state and diversify the postmining vegetation but the landowner wants vegetation that is exclusively for livestock use.

3. OSM Revegetation Team Survey Results Dr. Scott Boyce, Office of Surface Mining, Washington, D.C.

Academic Question (Required number of trees to plant per acre): I have not been able to find in SMCRA the mention of the word "tree" or the word "forest." The federal regulations say that we have to have 450 trees per acre for some uses and 250 trees per acre for others. The Department of Agriculture has a CRP program where their tree planting rates are lower than the rates required at bond release on SMCRA sites. Where did all of these seemingly magic numbers for tree planting come from?

Answer: In terms of numbers of trees per acre, there is no required number of trees to be planted per land use in the OSM federal regulations. It is up to each state to work with its appropriate forestry or wildlife agency to determine the appropriate tree planting requirements.

Academic Question (Government agency coordination): The Department of Agriculture seems to be encouraging farmers to plant trees on marginal croplands while miners are being discouraged from planting trees. Why can't these government agencies get together on what we need in terms of planting trees?

Answer: I have to agree that it would be desirable to get together with the Department of Agriculture to develop incentives to planting trees on reclaimed mine lands.

Session 2: Interest Group Perspectives on Constraints, Experiences, Trends, and Needs

1. Eastern State Perspectives on Tree Reclamation Mike Sponsler, Indiana Division of Reclamation, Jasonville, Indiana

Academic Question (Fragipan soils in southern Illinois): In southern Illinois, we have eroded fragipan soils. Fragipan soils by definition are dense poorly drained soils that are acidic and hostile to root growth. Yet we have a prime farmland requirement to replace these fragipan soils. You may have an A2 horizon associated with these soils that is toxic. I knew one mine superintendent that was totally frustrated because he was required to replace this material. Trees do not grow on these soils. You can spend a few thousand dollars and get corn to grow on these soils but you can grow corn on any soil if you spend enough money. Why are we doing this?

Answer: In southern Illinois and Indiana, these fragipans are definitely root constricting zones. Mining does present an opportunity to break up that fragipan. By using alternative subsoil materials and by proper handling, you can eliminate that compaction and create a mine soil that would be more productive than it was prior to mining for either trees or crops. You should restore the land in a way that maximizes options for use of the land in the future.

2. Reforestation in the Western States Michael Long, Colorado Division of Minerals and Geology, Denver, Colorado

No questions.

3. Impediments to Reforestation: Who Owns the Problem? David Finkenbinder, National Coal Association, Washington, D.C.

Academic Question (Consensus building): Concerning the meetings you have described between the regulators, landowners, and industry, who would attend those? I have found that in my discussions with people who work at the mine site, what they may see as concerns and what the company management people may say at meetings like

this may have little in common. So I am not really sure how useful these meetings may be if the right people are not at them.

Answer: You obviously need to have the right people at these meetings. That should be part of the outreach that goes into developing these meetings. I would agree with you that although there is no way to make the right people attend these discussions, it will not succeed unless they are there. For some reason, I have seen this happen more often related to hard rock mining than with coal mining.

Industry Comment (Regulatory predictability): We have been talking a lot about incentives and options and getting people involved, which is good; but when SMCRA first evolved it was decided that this would be good for the country. Certainly as a member of industry I appreciate regulatory certainty, knowing what is expected of me. If changes are made based on these discussions, then the regulatory requirements need to be revised so that it will be fairly and consistently carried out. It is best for the industry and the landowner to know what to expect in terms of the regulatory requirements.

4. Field Inspector/Historic View of Mine Reforestation in Tennessee Joseph Strange, Office of Surface Mining, Knoxville, Tennessee

Regulatory Question (Plant succession based on width of mining cut): As an inspector, I remember many pre-SMCRA reclamation sites involving outcrops. Under State law the operator was able to push 80 percent of the overburden on to an outcrop. I recall a lot of black locust and tall fescue being planted and nothing else with the black locust giving way to secondary successional species. Based on what you have shown here and what you are seeing, was that not the case?

Answer: Where the cuts were not too wide, then natural reseeding has occurred no matter what the area's original vegetation was. Where the cuts were wider there is less reseeding by adjacent native trees. From my experience, cuts wider than 100 yards have not reseeded naturally from surrounding vegetation.

5. Academic Research Perspective on Experiences, Trends, Constraints, and Needs related to Reforestation of Mined Land James A Burger, Virginia Polytechnic Institute and State University, Blacksburg, Virginia

Industry Question (Soil characteristics for good forest soils): Considering your slide showing the differences between growing trees on a poor site, an undisturbed site, and a well-reclaimed site at about 30 years of age, what were differences between the poorly and well-reclaimed sites in terms of soil characteristics?

Answer: The well-reclaimed site is a deep uncompacted mine soil that is from 3 to 5 feet deep composed of weathered sandstone overburden that is commonly found in the Appalachians in the surface overburden layer. The material quickly breaks up when brought to the surface. It creates a good forest soil that is slightly to moderately acidic. This is the material from which the undisturbed forest soils was generated and the trees are already adapted to this material. On the poorly reclaimed sites, the surface material is made up of overburden materials that come from unweathered layers at much greater depths. They are finely textured siltstone that grow grass very well. They have a pH of around 7 to 8 which is way too high for Appalachian forest trees. Water does not infiltrate these soils quickly; they are poorly aerated; and they are fairly salty, all of which makes them poor forest soils.

Industry Question (Overburden handling for forest soils): What are some of your recommendations for the treatment and storage of this soil material?

Answer: I am not talking about A horizon material. I am talking about the overburden material that is within the first 20 feet of the surface. Although, how this material is placed at a given mine site would have to be determined by the resident mining engineer, it should not be a difficult problem to obtain 3 to 5 feet of this material from the first 20 feet of overburden.

6. Perspectives Relating to the Establishment of Quality Wildlife Habitat on Mine Lands in Kentucky Steve Beam, Kentucky Dept. of Fish and Wildlife, Somerset, Kentucky

No questions.

7. Ohio's Perspective: A Practitioner's View Jim Stafford, Ohio Division of Forestry, Zanesville, Ohio

No questions.

8. Reforestation: A Landowner's Perspective Timothy Probert, Pocahontas Land Co., Bluefield, West Virginia

No questions.

9. Wildlife Perspectives in Reclamation Robert M. Morton, Kentucky Chapter of the Wildlife Society, Corydon, Kentucky

No questions.

Session 3: Status of Reforestation Technology

1. Status of Reforestation Technology: The Appalachian Region Dr. James A. Burger, Virginia Polytechnic Institute and State University, Blacksburg, Virginia

Academic Question (Relative acidity with sandstone substrate): Is the use of this weathered sandstone as the soil substrate compatible with getting water quality of pH 6.5 or greater as that is the requirement in Ohio?

Answer: I do not know the complete answer to that. We are still concerned about and looking at that.

2. Status of Reforestation Technology and Science in Southern Illinois Dr. Clark Ashby, (Emeritus) Southern Illinois University, Carbondale, Illinois

Question (Site index): As I have read the soil survey reports, soil types that have forest cover have a higher site index whereas the shallower, rocky soils have a lower site index. Why can't that carry through the reclamation process if the soil is properly replaced?

Answer: I think it could be, but if you look at prime farmland in southern Illinois, my question is whether or not it really is prime farmland. We need to be more careful in the classification of what is or is not prime farmland. If you really did have good prime farmland, you should have a high site index for trees.

Question (Planting methods): Concerning plant mortality in the cast ungraded overburden, do you experience higher levels of mortality because of the looseness of the soil materials? What planting methods work best in these types of material (containerized seedlings, bare root, etc.)?

Answer: Although we tried containerized seedlings, we prefer to plant bare root or direct seeding. There are areas when you have very sandy soils where the plants get washed out, but most of the material is quite rocky and has a silty to silty clay loam texture. It is fairly firm, and we do not have a problem with the trees being washed out.

3. Status of Reforestation Technology in Kentucky Dr. Don Graves, University of Kentucky, Lexington, Kentucky

No questions.

4. Use of Field Compaction Measurement to Predict Reforestation Success Dr. Richard Sweigard, University of Kentucky, Lexington, Kentucky

No questions.

Session 4: Case Studies of Reforestation in Mining Reclamation/Success and Failure

1. Pacific Northwest Glen Waugh, Office of Surface Mining, Olympia, Washington

State Question (Soil handling and revegetation methods): What were the soil handling and vegetation methods that helped most with the mines successful reforestation?

Answer: They do not have any toxic spoil materials. They have a very specific herbicide program to kill back the herbaceous species for one or two growing seasons prior to planting the trees. I do not remember any special soil handling techniques. They do not have any compaction problems with the sandstone subsoils. They do rip the herbicide strips prior to tree planting. The subsoil tends to be fairly loose.

2. Montana: Site Adapted Container Grown Woody Plants for Mine Reclamation Len Ballak, Bitterroot Restoration Inc., Corvallis, Montana

No questions.

3. Arid and Semiarid West Vernon Pfannenstiel, Peabody Coal Co., Flagstaff, Arizona

Academic Question (Native nitrogen fixers): I only heard you mention one native nitrogen fixing plant, snowberry. Have you tried any others?

Answer: No. We are using native species that are adapted to a low fertility environment. In these arid locations, if you apply any kind of extra fertilizer it is the kiss of death because the grasses and weeds take over rather than the native species that will occupy the site long term.

Academic Question (Shrub transplants): Please explain your strategy for establishing transplants of woody species.

Answer: This type of system was pioneered at the Trapper Mine in northwestern Colorado. They dig up root sprouting shrub clumps with a backhoe to a depth of one to two feet and replace them in the reclaimed area and pack some soil around them and water them once with a water truck to get them started. By the next year there is quite a bit of expansion by root sprouting. It is expensive but it gets the species that you want started back on the site.

Academic Question (Surface rock application): When you haul the rocks back on some sites do you also haul topsoil?

Answer: No, we do not put topsoil back on the rocky sites. In some cases, we bring in rock scoria over the subsoil so that it will be more like the natural conditions.

Academic Comment (Importance of small native pollinators): It was interesting to see that you found some of the small unvegetated sites were important; we also have found that this is important for recruitment of woody plant species, as well as for native pollinators, many that nest on the ground. We need to encourage these small pollinators. In our studies we found most of these small pollinators utilized the erosion gullies and were not found where there was a complete grass cover.

Answer: I think this points out that erosion is not always bad. Some of what we thought were going to be our worst areas turned out to be some of our best because they developed more naturally due to the lack of competition from planted vegetation. We were able to get better vegetation in the long run on these sites.

4. Texas Utilities Commitment to Reforestation Sid Stroud, Texas Utilities Services, Dallas, Texas

Academic Question (Regulatory restrictions on soil handling plans): What type of regulatory restrictions do have

on soil mixing and placement?

Answer: These decisions are ultimately determined by the Texas regulatory authority. Texas Utilities has done extensive studies on our overburden materials. These materials range from heavy clays to carbonaceous clays, acidic materials, deep sands, and gravels. We do an extensive stratigraphic overburden evaluation. We select the best available materials within a given mine area and develop overburden handling methods based on our stripping methods and meet our need to obtain plant growth media at least as good or better than that found in the premining condition. We have been very successful at getting approval for our soil handling plans using this method.

5. Successful Forestry Reclamation in Louisiana/Mississippi Marty Walker, North American Coal Corp., Ackerman, Mississippi

No questions.

6. Successful Tree Planting Techniques for Drastically Disturbed Lands: A Case Study of the Propagation and Planting of Container Grown Oak and Nut Trees in Missouri Stuart Miller, Missouri Land Reclamation Program, Jefferson City, Missouri

Regulatory Question (Germination inhibitors): You made reference to the allelopathic effects of tall fescue. Are there other species that have this same effect?

Answer: I know from the literature that there are some problems with annual rye, walnuts, and tomatoes. I have noted in the field that there seems to be some effect of pine duff that inhibits other vegetation but we need research to support this.

Regulatory Comment (Reforestation of AML sites): I would like to emphasize to the people involved with AML programs that the message presented here is that you do not need federal OSM approval to experiment with ways to improve reforestation. Alabama is a classic example in that they have made a commitment to reforestation by reforesting hundreds of acres through their AML program. This is a golden opportunity to use the present technology and funds to plant trees on AML sites.

7. Illinois/Indiana Chris Liebering, Liebering and Sons Reforestation, Lamar, Indiana

No questions.

8. American Electric Power Company Reforestation History on Reclaimed Mine Lands Gary Kaster, American Electric Power Land Management, McConnellsville, Ohio

No questions recorded.

9. Mycorrhizal Fungi and Trees: A Successful Reforestation Alternative for Mine Land Reclamation C.E. Cordell, PHC Reclamation, Asheville, North Carolina

No questions recorded.

10. Kentucky Reforestation Case Study Dan Williamson, Kentucky Reclamation Association, Madisonville, Kentucky

No questions.

11. Forest Productivity of Reclaimed Mined Land: A Landowner's Perspective Timothy Probert, Pocahontas Land Co., Bluefield, Virginia

No questions.

Session 5: Interest Group Recommendations to Enhance Reforestation

1. Eastern States Recommendations Mike Sponsler, Indiana Division of Reclamation, Jasonville, Indiana

Academic Question (Opportunities for improvement of soils): Because many of the soils that we have prior to mining have been historically mismanaged and no longer have the good topsoil material they had prior to farming, do we really want to restore it as is or should we try and use the mining operation as an opportunity to make it better for future generations? Southern Illinois has very old soils that are not very productive in comparison with the young glacial soils of northern Illinois, why shouldn't we give them a boost in productivity by using fresh overburden materials for root growth media?

Answer: I would agree with you and when I say to put back suitable soils that does not preclude the use of alternate materials. This is being done by Arch of Illinois with their bucket wheel technology that has created superior soils after mining. This is good for agriculture and for forestry. The regulations require that the operator make a demonstration that the alternative is better than the original soils then that is what should be used. There are areas in southern Illinois that have poor soil conditions like fragipans, and there are ways to overcome those problems. There also are areas that have good preexisting soil materials that will grow crops or trees if they are replaced properly. The flexibility is already there to do what you suggest. If some operators are improperly replacing and handling their soil resources in a way that produces a compacted unproductive soil then I do not agree with that. We should be planning for putting back the optimum soil.

2. Enhancement of Reforestation at Western Surface Coal Mines Ronald Daniels, Utah Division of Oil, Gas, and Mining, Salt Lake City, Utah

No questions.

3. Coal Industry Recommendations David Finkenbinder, National Coal Association, Washington, D.C.

No questions.

4. Field Inspector Recommendations Vic Davis, Office of Surface Mining, Knoxville, Tennessee

No questions recorded.

5. Academic Research Dr. James Burger, Virginia Polytechnic Institute and State University, Blacksburg, Virginia

Regulatory Question (Tree productivity and bond release): You mentioned changing the revegetation success standards, and you have demonstrated methods for measurement of mature forests; then your last recommendation was that we create incentives for bond release. Are these two suggestions working against each other?

Answer: This is not a good comparison, because the fundamental purpose of SMCRA is to return land back to its original level of productivity.

Industry Question (Site index development): I agree with your concerns about measuring forestry success by counting stems. I have problems equating that with what we get on crops or pasture. These crops are planted with standardized equipment and standardized methods. The problem is that I don't know how you can develop a valid site index within the five year liability period.

Answer: I think it should be done through the development of a mine soil quality index. If you know the soil quality is there based on the properties of the soils then you do not need any type of bioassay. Because trees take so long to grow, foresters have developed natural soil quality indices that are surrogates for the site index. There are hundreds of those types of studies that were done back in the 1950s through the 1970s. I have even done some of this for

mine soils and have a pretty good initial model that is very promising. It can be done.

Industry Comment (Landowner acceptance of soil substitutes): On the promotion of soil substitutes, if the incentives that are developed out of this forum that promote soil substitutes are enforced, I can take that to a landowner. If I take something I have developed on my own, I will have big problems with my landowners. If there are soil substitutes that are determined to be better than topsoil, then the regulator needs to be standing there with me when I am discussing this with the landowner and his expectations what his land will look like at bond release.

Inspector Question (Erosion control and site indices): The obstacles to planting trees effectively seemed to include the 9 inch rill and gully rules. The operator wants to keep from having a 9 inch gully which makes tree planting secondary to the establishment of an aggressive erosion control cover. If we can get past the need for the 9 inch rill and gully rule on forest land uses, then perhaps we can have a companion provision in the revegetation requirements where we could have a lower minimum number of trees planted and that a certain number of them would have to reach a minimum height at the end of the responsibility period as a productivity standard.

Answer: I think that the 9 inch rill and gully requirement is going by the wayside in most states. I also think that people in mining are beginning to realize that less is more in terms of less herbaceous cover is better for trees. Also, we need to realize that there is not a problem with a little erosion as long as it is not compromising water quality or becoming a burden on the operator in terms of the need to dredge out sediment ponds. The idea of using trees as an indicator of site productivity is a little tricky. I had proposed using white pine as a site indicator because it has the unique property of a 1:1 growth rate. I do think that there is a lot of promise in using a mine soil property index to evaluate the site capability.

Academic Comment (Invasive species and biodiversity): We now have an executive order that we should fight the establishment of invasive species on our lands. It would seem that eventually these concerns should be incorporated in the regulations to prevent species like autumn olive and other exotic species from being planted on reclaimed lands as has been done in the past. Second, there has been some discussion about increasing ecological function and biodiversity on reclaimed lands. When the target is not production forestry but habitat, then there must be a landscape perspective. Even the most concerned land manager could only introduce through active plantings perhaps a dozen species where a more representative biodiversity would be order of magnitude greater than that. Whether these species can invade at a later time depends in large part on how large the aerial extend of the mine site. As we move from a few hundred, to thousands, to tens of thousands of acres, it strikes me that the ability to invade to a premining biodiversity really is challenged. What are the effects of scale on these invasion processes and the potential to get back to a more natural biodiversity?

Answer: I can not address the question of scale. It has been shown fairly conclusively that if the land has been restored in a productive state, natural succession processes are much faster both temporally and spatially and in terms of composition. As land quality increases and productivity increases, then so does every other ecosystem function, which should include biological diversity.

6. Kentucky Fish and Wildlife Resources Department Steve Beam, Kentucky Department of Fish and Wildlife, Somerset, Kentucky

Academic Comment (Edge species): Concerning edge species, in southern Illinois edge has become a bad thing related to cowbirds parasitizing song birds.

Answer: The reason we are talking about edge in Kentucky is because the mining regulations say the operator must optimize edge when replacing fish and wildlife habitat. We have promoted edge historically because of its use by game species. Now we are having to throw on the brakes because there are a lot of species for which edge is very detrimental.

Academic Comment (Endangered species): In southern Illinois, the coal companies are selling their land as fast as possible because of concerns about possible difficulties, if rare or endangered species are found there. Also, concerning perch poles, this was tried by the operators about ten years ago with the result that people were coming

along and shooting the hawks off of the perch poles. The perch poles were making the hawks very visible and easy targets. What the operators are doing now is to mow lanes so that the rodents are without cover as they cross the lanes which gives the hawks and owls a chance to catch them.

Answer: The issue of endangered species. We are talking about making an area better for wildlife habitat. You may at some point benefit some endangered species. Usually the potential for problems for a mining company comes when they first permit an undisturbed area and have to conduct a survey for endangered and threatened species.

Academic Comment (Spoil settlement): Considering the spoil settlement, some of these areas are quite unstable and settle considerably as a function of thickness and age. Many of the talks today have shown reforestation of very flat areas, over time these areas will settle up to about 1.5 feet per year during the early years. This creates depressions. When you plant trees on this type of flat area, these depressions have the potential to flood with water and drown the trees. I have had consultants come to me because they can not get bond release because of the wet depressions. I would recommend that, in addition to your emphasis on minimizing compaction, we look at developing a rolling topography or internal drainages that would allow this water to run off the site.

Regulatory Comment (Creating water and wetlands): Concerning your recommendation that we make water available on these forested sites, OSM not only allows but encourages the conversion of sediment ponds, impoundments, and the leaving of depressions to be converted into wetlands. A couple of years ago we published a directive (TSR 14) that tells how to do that. That option is available.

7. Ohio Division of Forestry Jim Stafford, Ohio Division of Forestry, Zanesville, Ohio

No questions.

8. Landowner Timothy Probert, Pocahontas Land Co., Bluefield, West Virginia

No questions.

9. Kentucky Chapter/The Wildlife Society Robert M. Morton, Kentucky Chapter of the Wildlife Society, Corydon, Kentucky

Academic Question (Removal of sediment ponds): I don't know why the operators have to take out their sediment ponds. This is also the case in southern Illinois. Also, I have seen operators removing contour terraces. Why is this the happening?

Answer: In most of the cases I am familiar with, the sediment ponds were never approved in the permit to be retained after mining and reclamation. They were just designed for temporary use and could not meet the requirements to be included in the final bond release. I have no knowledge concerning the removal of contour terraces.

Answer: What you are usually seeing is that any impoundment that will be retained after mining and reclamation must be constructed to safely pass a particular designed flow of water. Since the impoundments were not constructed to pass the design flow for a permanent structure, the operator has the choice to make the changes so that it will meet the design flow standards for a permanent structure and will not be hazard in terms of its likelihood to wash out or to remove the structure. So it is usually an operator choice to upgrade the discharge structure or remove the pond. There is no bias in SMCRA against leaving ponds.

Answer: The landowner must also be willing to take over maintenance of the pond. Some land owners are not interested in taking on the maintenance of the ponds.

Participant Interactive Discussion

Industry Comment (The value of topsoil): From a midwestern standpoint, I would have a problem with any loss of

topsoil in this region. The topsoil in this region is a very valuable agricultural resource that should not be wasted. Topsoil has been under assault ever since the beginning of SMCRA. I have witnessed thousands of acres of land in Indiana grandfathered under SMCRA that were then turned upside down. I saw an entire topsoil stockpile, including the topsoil marker sign, thrown into a pit one Sunday morning. Things like this have gone on for the last 20 years. I can support many of the incentives that I have heard talked about at the forum, as long as they are done on a site specific basis rather than broad brush. If topsoil substitution with overburden and minimal grading was applied across the board, we would be turning the clock back to pre-SMCRA days.

Why are we not able to have land use trading credits in the same way we have emission credits? If we have a company that is good at replacing crop land and pasture and another company that is better at replacing forests, maybe these companies could get together and trade land use credits.

Academic Comment (Research for forest friendly herbicides): What can OSM or anyone else do concerning conducting the necessary research to develop forest friendly herbicides?

Academic Comment (Pond design): West Virginia recently passed some new requirements for ponds and dams. I noticed that the previous ponds put in under the Soil Conservation Service are now considered to not be in compliance because they no longer meet the requirement for an adequate spillway.

Academic Comment (Livestock for rodent control): I would like to suggest that by using livestock to graze the areas planted to trees during the winter months when the trees are dormant, we may do more to reduce the rodent population than we can do with hawks and owls.

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