

Evaluation of wildlife response to vegetation restoration on reclaimed mine lands in southwestern Virginia

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Introduction

Environmental and land use studies are frequently conducted on reclaimed coal mines, but limited work has been done to determine the response of wildlife populations to these reclamation efforts. Land use is typically changed following the mining process, and post-mining habitat and land-use may be strikingly different from their former composition. Changes in vegetative cover, vegetation type and composition, soil properties, and topography can provide different resources for wildlife use than those previously available. There is the chance to “improve” habitat, or at least provide substrates or topography that may be lacking in adjacent areas, if planned properly ahead of time (Scott and Zimmerman 1984).

Wildlife are often displaced from their native environments after mining, and may not return without the appropriate resources necessary for their survival. Disturbances to wildlife during a mining operation include more than just excavation at the actual mine pit. Impacts can be widespread and affect areas adjacent to and removed from the mine site. Other disturbances affecting wildlife and their habitat include the construction and use of temporary road systems and heavy machinery, noise, erosion, changes in topography and landforms, loss of native vegetation and cover, and sometimes environmental health concerns. Habitat complexity is often reduced following mining or other disturbances, causing a shift in the composition of wildlife communities such as birds (Wray et al. 1982). For example, a mature forest will support different species and abundances of birds than an open shrubland or managed pasture.

This project focuses on studying avian and amphibian communities on reclaimed mine sites. Wildlife such as birds often act as initiators of succession on barren sites that lack initial seed banks. These early initiators often contribute greatly to the revegetation process by transferring seeds to the area through droppings or food transfer (Walker and del Moral 2003). Amphibians, on the other hand, are a sensitive group and play an essential role in the cycling of nutrients into the food chain. Amphibians often represent the largest component of biomass in Eastern forests, making them an important component of the ecosystem. In recent years, there have been ample data to suggest that substantial amphibian declines have occurred throughout their range due to habitat disturbance and other anthropogenic influences. Because of strong site fidelity and limited dispersal capacity, even small disturbances that result in habitat fragmentation could isolate amphibians from important breeding or foraging habitat necessary for survival (Krishnamurthy 2003). Even though amphibian species that inhabit the coal-producing regions of North America have not shown signs of imminent danger, by understanding the habitat designs that impact these species, we can apply these findings to species in other geographic locations (Lacki et al. 1992).

This purpose of this study is to monitor wildlife use on mined sites of varying ages (since mining) and post-mining cover types at two locations in southwestern Virginia. Bird, salamander, and frog communities are being sampled to gain an understanding of site use and species composition. This information will be compared with wildlife communities on nearby reference forests to better understand the impacts of mining and reclamation.

Objectives

Our research intends to contribute to our understanding of wildlife use of reclaimed mine lands. The specific objectives are:

1. Determine avian and amphibian community composition in different age classes of reclaimed mined lands that have been restored to wildlife habitat and forest post-mining land uses.
2. Compare avian and amphibian communities of reclaimed wildlife habitat and forest communities to: (1) reference forests that have not been recently disturbed by mining and (2) forests that are regenerating after harvesting.
3. Compare the structure and composition of reference forests to that of forests established on reclaimed sites, and compare the response of selected wildlife species to habitat patterns on reference and reclaimed sites.
4. Develop guidelines that can be used to suggest means to reclaim sites with forests that will meet wildlife objectives.

Overview of Methods

Field work is being conducted at the Powell River Project site in Wise County, Virginia, and also at the Public Access Lands for Sportsmen (PALS) property owned and managed by The Forestland Group, LLC in Dickenson County. We have completed the first year of data collection for this two year study.

We used a random-stratified sampling design to sample from 6 dominant age classes and cover types: pre-SMCRA, early successional, mid-successional, managed pastureland, reference, and recently harvested reference (Table 1, Figure 1). Pre-SMCRA sites are those that were mined prior to the institution of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). We also established study sites on areas that have been mined and reclaimed since the establishment of SMCRA, which are further divided into early successional (approximately 5-12 years since mining), mid-successional or “teenage” stands (approximately 12-20 years since mining), and those that are actively managed for livestock grazing purposes. Reference forests in close proximity to mining sites were also sampled to gain understanding of the composition of and wildlife associated with the forest prior to mining. In addition to reference forests that were not recently disturbed, forests that have been disturbed recently by traditional forestry practices such as clearcutting were also sampled.

Table 1. Sampling point distribution across study areas (Powell River Project [PRP] and Public Access Lands for Sportsmen [PALS]) and vegetation cover type categories.

Cover Type	Number of sampling points		
	PALS	PRP	TOTAL
Early successional (~5-12 years)	11	10	21
Mid successional (~13-20 years)	3	7	10
Harvested (<i>within the last 15 years</i>)	6	2	8
Managed pastureland	10	3	13
Pre-SMCRA (prior to 1977)	28	6	34
Reference/ mature	8	8	16
TOTAL	66	36	102

Figure 1. Representative photos of general cover type categories used to distribute sampling points. Photos were all taken at sites on the PALS site.

A. Early successional



B. Mid-successional



C. Harvested



D. Managed pastureland



E. Pre-SMCRA



F. Reference/mature



Bird sampling

We used point counts with a 50 m radius to sample the bird community at each point. This consisted of a 5 minute count with a 1 minute waiting period following arrival to the point where species of birds heard and/ or seen were tallied. During the 2007 field season, each point was visited 5 times between May 14 and July 10. All surveys were conducted between 6 and 9 am on clear mornings with minimal winds. Distance from the observer to the bird and any behavior or habitat use is also noted during surveys. This will allow for estimates of relative abundance and density of bird species during data analysis. We also noted whether the bird recorded was using the cover patch being sampled, or was in an adjacent habitat patch. A summary of birds observed the first field season is provided in the Appendix.

Salamander sampling

Two methods were used to sample salamander populations. First, a series of coverboards were placed in habitat types of interest to act as artificial wood structures that provide habitat for salamanders. These boards are approximately 20 x 10 x 5 cm in size and were placed in arrays of 6 boards in each site being sampled. They were checked no more than once a week for salamanders. Data recorded includes the species, weight, and length (snout-vent length and tail length) for each salamander captured. Coverboards will be checked from June-September each year.

In addition to coverboard surveys, constrained time searches were also done on appropriately rainy, humid evenings in the summer months when salamanders would be actively foraging and generally visible on the surface. This procedure consists of the observers actively searching for a constrained amount of time at each cover type of interest. Three observers and a 20 minute time limit were used for 2007 surveys. We also recorded salamander encounters, or incidental observations of species while conducting other work on the sites. Tables 2 and 3 present a summary of data collected on salamanders during the 2007 field season.

Table 2. Salamander species detected during May- July 2007 at PRP. As of July 15, only one night search was conducted for salamanders due to unusually dry weather.

Species	Night searches	Coverboard surveys	Encounter	Cover type where observed
Northern red salamander	X			Pre-SMCRA
Red-spotted newt (Red eft)	X	X	X	Pre-SMCRA, reference
Slimy salamander	X			Reference
Spotted salamander	X			Reference
Southern two-lined salamander		X		Pre-SMCRA

Table 3. Salamanders detected during May-July 2007 at PALS. As of July 15, no night searches were conducted for salamanders due to unusually dry weather.

Species	Night searches	Coverboard surveys	Encounter	Cover type where observed
Red-spotted newt (Red eft)			X	Reference, pre-SMCRA
Red-spotted newt (Adult phase)		X		Mid-successional (pine)

Frog sampling

Frogs were sampled on wet evenings using frog call survey methods. Water bodies were visited following a rain event or on wet, humid evenings and frog calls were identified by species and ranked in intensity. We also recorded frog encounters, or incidental observations of species while conducting other work on the sites (Tables 4 & 5).

Table 4. Frog species detected during May-July 2007 at PRP. As of July 15, two call surveys were conducted for frogs.

Species	Call surveys	Encounter
Gray treefrog		X
Spring peeper	X	
Upland chorus frog	X	
Green frog	X	
Bullfrog	X	
Fowler's toad	X	

Table 5. Frog species detected during May-July 2007 at PALS. As of July 15, no call surveys were conducted for frogs due to unusually dry weather.

Species	Call surveys	Encounter
Spring peeper		X
Green frog		X
American toad		X

Habitat sampling

Habitat data were also collected at each point that was surveyed for birds and/or salamanders. The procedures were adapted from Noon (1981), and consisted of 4 sub-plots to measure components of interest at each wildlife sampling point. Habitat characteristics of interest include species and diameter at breast height (DBH) of trees, shrub density, canopy and ground cover, slope, canopy height, and tree and log dispersion. We will analyze the abundance and distribution of birds and salamanders in relation to these habitat features in the future.

Expected Outcomes

Ultimately, we will obtain a better understanding of what species use reclaimed mine sites, and which practices used during the reclamation process are most attractive to wildlife. Because of the sensitivity of many wildlife species, especially amphibians, to disturbance, we hope to use our results as an indication of the potential of mined sites to support wildlife and suggest reclamation efforts that could be used to attract wildlife. With this knowledge, we will be able to recommend reclamation practices that provide adequate habitat for wildlife and support wildlife habitat as a viable land use under current SMCRA requirements.

References

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Appendix. Bird species encountered at survey points in 6 cover types sampled on the Powell River Project (PRP) and the Public Access Lands for Sportsmen (PALS) sites in Wise and Dickinson County, VA, 2007. Cover types sampled were unharvested reference forest (Reference), forest harvested with traditional forest management methods (Harvested), pre-SMCRA reclaimed sites (Pre-SMCRA), early successional (5-12 years) reclaimed sites, older (12-20 years) reclaimed sites (Mid Successional.), and sites reclaimed to pasture (Pasture). A 1 indicates the bird was observed using the cover type being sampled; a 2 indicates the bird was observed in habitats adjacent to the sampled site. Bird observations were made during 5 early morning surveys on each of 102 sampling points distributed across the sites during May, June, and July, 2007.

Species	Cover type and Study Area												
	Early Successional		Mid-successional		Harvested		pasture		pre-SMCRA		Reference		
	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	
Acadian flycatcher												1	
American crow	1,2	1,2	1,2	1,2			1,2	1,2	1,2	1,2	1		1
American goldfinch	1	1	1,2	1,2		1		1	1	1			
American kestrel												1	
American robin	1	1	1	1		1		1	1	1			1,2
American woodcock										1			1
Barn swallow							1	1					
Barred owl					1								
Black-and-white warbler	2	2	1		2	2			1,2	1,2	1		1
Black-throated blue warbler	2	2	1,2	1,2		2			1,2	1,2	1		1
Black-throated green warbler					2				1,2	1,2	1		
Blue jay		1,2		1		1,2		1,2	1	1	1		1
Blue-gray gnatcatcher		1								1			
Blue-headed vireo		2							1,2	1,2	1		1
Blue-winged warbler	1	1		1		1				1	1,2		,1,2
Brown thrasher								1		1			
Brown-headed cowbird				1,2		1	1	1		1			
Carolina chickadee		2	1,2	1,2	1	1,2		2	1	1	1		1
Carolina wren	2	2	1,2	1,2		2	2	1,2	1,2	1,2	1		1
Cerulean warbler				1,2		2							1
Chimney swift		1								1			
Chipping sparrow	1,2	1,2	1	1	1,2	1,2		1	1	1	1		1
Common grackle								1	1				1
Common yellowthroat	1	1	1,2	1,2			1		1	1	2		
Cooper's hawk				1					2	1			
Downy woodpecker	1	1	1	1		1		1		1	1		1

Appendix, Continued.

Species	Cover type and Study Area											
	Early Successional		Mid-successional		Harvested		pasture		pre-SMCRA		Reference	
	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS
Eastern bluebird								1				
Eastern meadowlark	1	1	2				1					
Eastern phoebe	1,2		1			1			1	1		
Eastern towhee	1	1	1,2	1,2		1	1,2	1,2	1	1	1,2	1,2
Eastern wood-pewee	1,2					1		2		1	1	1
European starling	1						1	1				
Field sparrow	1	1	1,2	1,2			1	1	1	1	2	2
Golden-winged warbler											1	
Grasshopper sparrow	1						1	1				
Gray catbird	1,2	1,2	1				1			1	1	1
Hairy woodpecker		1								1		
Hawk spp.												1
Hooded warbler	2	2	1		1	2		2	1,2	1,2	1	1
Indigo bunting	1	1	1,2	1,2		1	1	1	1	1	2	2
Kentucky warbler							1		1			
Killdeer	1											
Magnolia warbler											1	1
Mallard							2					
Mourning dove	1	1	1		1	1	1	1	1	1	1	1
Northern bobwhite	1		1	1			1	1	1		2	
Northern cardinal	1	1	1	1		1	1	1	1	1		1,2
Northern mockingbird	1			1			1	1		1		
Northern parula									1	1	1	1
Ovenbird			1		2	2			1	1	1	1
Pileated woodpecker	2		1,2				2	2	1	1	1	1
Pine warbler										1		
Prairie warbler	1	1	1				1	1			2	
Red-bellied woodpecker							1					
Red-eyed vireo	2	2	1,2	1,2	2	2	2	2	1,2	1,2	1	1
Red-shouldered hawk							2					
Red-tailed hawk		1					1			1		
Red-winged blackbird	1		1				1	1	1	1		
Ruby-throated hummingbird						1		1		1		1
Scarlet tanager			1		1	2		1	1,2	1,2	1	1
Song sparrow	1	1	1				1	1		1		
Tree swallow	1						1	1				

Appendix, Continued.

Species	Cover type and Study Area											
	Early Successional		Mid-successional		Harvested		pasture		pre-SMCRA		Reference	
	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS	PRP	PALS
Tufted titmouse	1,2	1,2	1	1		2		2	1	1	1	1
White-breasted nuthatch					1						1	
White-eyed vireo	1	1	1			1					1	
White-throated sparrow		1										
Wild turkey		1		1				1		1		1
Willow flycatcher						1						
Wood duck	2											
Wood thrush		2	1			2		2	1,2	1,2	1	1
Woodpecker spp.		1	1			1,2		2	1	1	1	1
Worm-eating warbler		1										
Yellow-billed cuckoo		1,2	1						1	1	1	
Yellow-breasted chat	1	1	1,2	1,2		1	1	1	1	1	2	2
Yellow-rumped warbler				1								