Wildlife Response to Surface Mine Reclamation in Southwest Virginia

Annual Report to Powell River Project
August 2011

Chris E. Latimer and Dean F. Stauffer
Department of Fish and Wildlife Conservation
Virginia Tech

Introduction

Post-mined lands can be managed for a number of different land uses including managed pasture for grazing livestock, commercial forest products, outdoor recreation, and carbon sequestration. Regardless of the post-mining land use , there will always be opportunity to manage the land to provide suitable wildlife habitat. For example, several studies suggested that the new environments created by strip mining are beneficial to wildlife not common to the area or that are suppressed by limited resources and competition (Allaire 1978, Whitmore and Hall 1978, Rohrbaugh and Yahner 1996 Bajema et al. 2001). Much of the area affected by coal mining in Virginia is forested ridgetops which provide important nesting habitat for species of concern such as the cerulean warbler (*Dendroica cerulea)*; however, reclaiming strip mines creates large amounts of early successional habitat used by many other species that are currently in decline such as the field sparrow (*Spizella pusilla),* golden-winged warbler (*Vermivora chrysoptera),* and yellow-breasted chat (*Icteria virens)* (Carrozzino 2009). Therefore, reclaimed strip-mines provide a unique opportunity to study habitat use by birds and identify critical components of the habitat that are important for management.

Loss of breeding habitat due to fragmentation has been hypothesized as a major cause of population declines in forest-nesting Neotropical migrant birds (Donovan and Flather 2002). Surface mining activities can also lower the structural diversity of various cover types and may lead to structural and compositional changes in avian communities (Wray et al. 1982). Changes in cover types could also cause a change in the predator community and thereby alter predator-prey dynamics. Sedimentation from erosion can impact aquatic habitats and the various vertebrate and invertebrate communities associated with them. Other environmental issues that may impact wildlife populations on surface mines include noise, air quality, construction and use of temporary road systems, and environmental contamination.

Many studies have focused on the negative impacts of surface mining activities on wildlife; however, few studies have assessed the value of post-mined lands as wildlife habitat and provide management recommendations for the development of suitable habitat for wildlife (Carrozzino 2009). Carrozzino (2009) found a predictable trend between breeding bird species richness, and abundance and successional stage on reclaimed surface mines. While her study confirmed suitability of reclaimed mine-lands for some wildlife, species richness and abundance may not be reliable measures of habitat quality in all cases (VanHorne 1983). An understanding of nest-site selection and nesting success is important to understanding the ecology and evolution of species and to develop management recommendations (Rodewald 2004). Such knowledge will contribute to our understanding of the contribution of reclaimed mine lands to sustaining populations of bird species of concern.

The primary focus of this study is to determine breeding success of birds nesting on reclaimed mine sites, specifically focusing on sites reclaimed using the Forest Reclamation Approach (FRA)(Burger et al. 2005). The continued monitoring of avian populations will contribute to the data collected by Carrozzino (2009) in order to evaluate changes in avian community structure over a 5-year period as the reclaimed sties mature. In 2010, we collected data on the use of reclaimed mine sites by medium and large sized mammals but did not continue monitoring in 2011 because of issues of vandalism encountered in 2010. We did not expect a significant change in the mammalian community over a 1 year period.

Research Objectives

This research is intended to contribute to our understanding of wildlife use of reclaimed mine lands. The specific objectives are:

1) Assess breeding bird community composition in various cover types reclaimed for different post-mining land uses on Powell River Project.
2) Monitor breeding success of songbirds (with emphasis on species of concern in Virginia) in varying mine reclamation regimens specifically focusing on sites reclaimed to hardwoods and are FRA compliant.
3) Determine what environmental factors may influence breeding success of songbirds in different cover types.
4) Model finite rate of increase of common songbird populations on the Powell River Project, using survival estimates from other studies in the region and our estimates of nest success to determine to what extent reclaimed mine lands contribute to populations.
5) Assess mammal community focusing on potential avian nest predators at The Powell River Project to determine its use of reclaimed mine sites and relate distribution and abundance to habitat conditions.
6) Relate information gained in this study to previous information about wildlife management on reclaimed mine sites to make recommendations about reclaiming lands for wildlife use.

Overview of Methods

Field work was conducted at the Powell River Project site in Wise County, Virginia, and surrounding reclaimed surface mines in Appalachia, Dickenson and Russell Counties. Sites for this study were chosen from patches of relatively homogeneous vegetation cover of similar age, reclaimed under the same technique (pre-SMCRA, FRA, grassland/pasture). Because of the relatively recent development and application of the Forest Reclamation Approach, availability of FRA sites is limited and most FRA sites are <20 years old. Therefore, in an effort to increase sample size, we also sampled sites that were FRA compliant. Because the maximum age of existing FRA site is <20 years of age, we only considered sites that had been reclaimed or undergone natural succession within the past 20 years. Because we are evaluating differences in patches reclaimed using different techniques, pre-SMCRA sites (no active reclamation) were sampled to collect baseline data. We located as many patches as possible on the 2 study areas that were large enough (3-4ha) for sampling and met the above constraints. Some patches were large enough to contain multiple sampling points; therefore, the number of sampling points was appropriate to the size of the patch sampled such that each point was >200m apart (Table 1).

Table 1. Number of points and location of study sites in Wise and Dickinson Counties, VA. For the 2010 and 2011 field seasons.

	# of points		
Site	2010	2011	Location
Powell River	32	36	Wise
PALS	7	34	Dickenson
Mud-Lick Creek	4	0†	Above Appalachia
TNC Flint Gap	4	4	Russell

† Mud-Lick Creek sites were not sampled in 2011 because they were inaccessible by vehicle.

Bird Sampling

Survey points in pre-SMCRA, pasture and traditional reclamation cover types were adopted from Carrozzino (2009) and additional points were located within FRA and FRA-compliant cover types. We used variable radius point counts to record bird species and distance from point center to each individual bird. Laser rangefinders were used in 2011 to help aide in distance estimation. Sex and age class (if known) were also recorded for each individual. Each point was visited 4 times between May 18 and Aug 9 in 2010 and 5 times between May 10 and June 24 in 2011. All counts lasted a total of 5 minutes with a 1-minute “settling period” after arriving at each point. All surveys were conducted between 6 and 10 am on clear mornings with minimal wind. Observers and time of day were alternated between counts to minimize any biases that may occur. In 2011, observers used a rangefinder to aide in distance estimation.

Nests were located from late April to mid-July by using behavioral cues and systematically searching potential nesting substrates. A total of 58 nests from 18 different species was located in various cover types in 2010. In 2011, we focused our search efforts on field sparrows and indigo buntings to help increase our sample size. We found 54 nests of 6 species in 2011, bringing the overall total number of nests across the 2 year sample to 112 nests of 19 species. (Table 2, Figure 1). Nests were checked every 2 to 3 days to monitor the contents and status of the nest. Steps were taken to minimize disturbance around the nest and to avoid potentially leading predators to the nest. A pole with a mirror was used to check the contents of nests located higher in the canopy as well as in the shrub layer to minimize disturbance.

Habitat measurements were taken within 10 days of the successful completion (at least one young fledging) or failure of a nest. Measurements were taken at 2 different spatial scales at used and unused nest sites. Unused sites were determined by choosing a random compass bearing and pacing at least 30m to the nearest nesting substrate of the same plant species as the used nest-site. At the area surrounding the nest within a 1m radius, we measured the following habitat characteristics: nest height (m), nest substrate (spp. and DBH if applicable), distance from center of nest to center of substrate, distance from the center of the nest to the edge of the substrate, and distance of nest to nearest edge (the junction between two different cover types, or the same cover type with visible differences in age). Each edge was scored on a scale from 1 to 5, with 1 representing little contrast between 2 patches (same cover type, different age) and 5 representing the greatest contrast (e.g., junction between forest and pasture). Percent concealment of the nest was measured by visually estimating the percentage of the nest that was constructed by vegetation from 1m in each cardinal direction, above and below and then averaged to obtain an estimate of the total concealment.

Habitat measurements were also taken at the patch scale, defined as the area encompassed by a 0.04ha circular plot centered on the nest. At this scale, we measured percent canopy cover, canopy height, density of trees > 10 cm diameter at breast height (DBH), density of stems > 4 and < 10cm DBH (saplings/poles), and density of stems < 4cm DBH (shrubs). An estimate of understory foliage volume was obtained by using a standard vegetation profile board (Nudds 1977) divided into 5 height intervals, 0-0.5m, 0.5-1m, 1-1.5m, 1.5-2m and 2-2.5m. The board was 2.5m tall and 30.48cm wide with alternate black and white colors at 0.5m intervals. The proportion of each 0.5m interval covered by vegetation was be recorded on a scale from 1 to 6, corresponding to the 6 cover classes presented in Daubenmire (1959). Readings were taken 10m in each cardinal direction from the nest at a height of 1m and the average for each 0.5m interval will be used in analyses. Percent ground cover by category (grasses, forbs, woody vegetation <1m, moss, leaf litter), percent bare ground, rocks, and percent coarse woody debris (CWD, woody vegetation > 8cm DBH and >1m long) were also taken by using the point intercept method.

Table 2. Number of nests by species located on reclaimed mine lands in Wise and Dickinson Counties in 2010 and 2011.

	# Nests	
Common name	**2010**	**2011**
Black-and-white warbler	2	0
Blue-gray gnatcatcher	1	0
Blue jay	2	0
Brown thrasher	2	0
Cedar waxwing	1	0
Chipping sparrow	1	0
Common yellowthroat	0	1
Field sparrow	17	34
Gray catbird	2	0
Golden-winged warbler	1	0
Hooded warbler	1	0
Indigo bunting	15	15
Northern cardinal	1	0
Prairie warbler	3	1
Red-eyed vireo	2	0
Red-winged blackbird	1	0
Grasshopper sparrow	2	0
White-eyed vireo	2	0
Wild turkey	1	1
Yellow-breasted chat	1	3
Totals	58	55

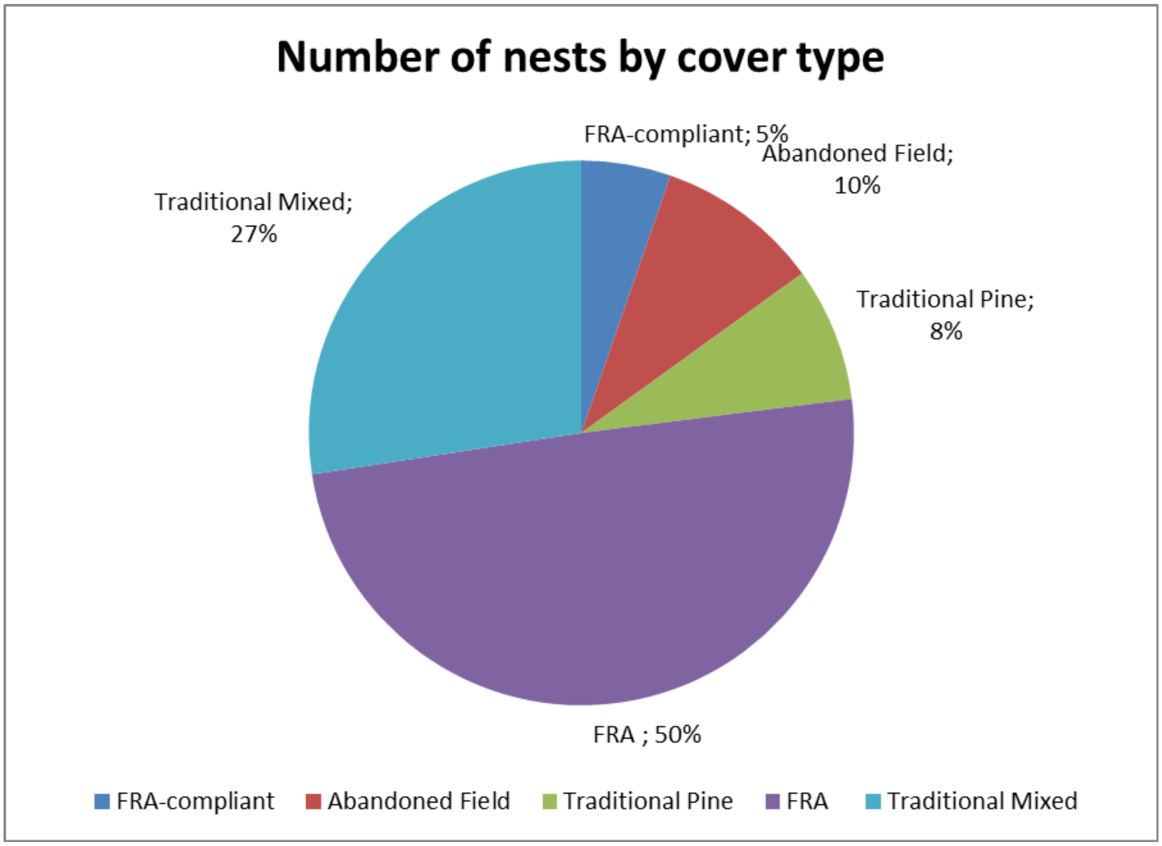

Figure 1. Number of nests located in cover types sampled in Wise and Dickinson Counties, VA, 2010 and 2011.

Mammal sampling

Remote sensing camera-traps were used to inventory mid- to large-sized mammals in different cover types at the Powell River site in 2010. Cameras were spaced approximately 1km apart in areas of suspected animal activity (based on scat, trails, and tracks). A total of 9 camera-traps was deployed from June 5 through July 13, totaling 38 trap-nights per camera for a total of 342 trap-nights for the entire study area. Camera-traps were taken down early as a result of theft on the Powell River Project. Animal activity was calculated as the number of independent capture events for a single species divided by the total number of trap nights, and relative animal activity was calculated as the number of independent capture events for a single cover type divided by total capture across all cover types (Figure 3, Table 2). Consecutive photos of the same species were considered independent events if individual animals can be unambiguously identified, or if the interval between capture events was >30 minutes (Michalski and Peres 2007).

Table 3. Relative animal activity by cover type. Numbers expressed as # animals/# trap nights.

Relative Animal Activity								
	Black Bear	Bobcat	Coyote	Gray Squirrel	Raccoon	White Tailed Deer	Wild Turkey	Other
FRA	0.20	0.00	0.20	0.00	1.00	0.13	0.40	0.50
Early	0.40	0.50	0.60	1.00	0.00	0.71	0.35	0.10
Mid	0.13	0.00	0.00	0.00	0.00	0.08	0.00	0.20
Ref	0.13	0.25	0.20	0.00	0.00	0.08	0.17	0.00
PreSMCRA	0.13	0.25	0.00	0.00	0.00	0.00	0.08	0.20

*Trap nights = 342

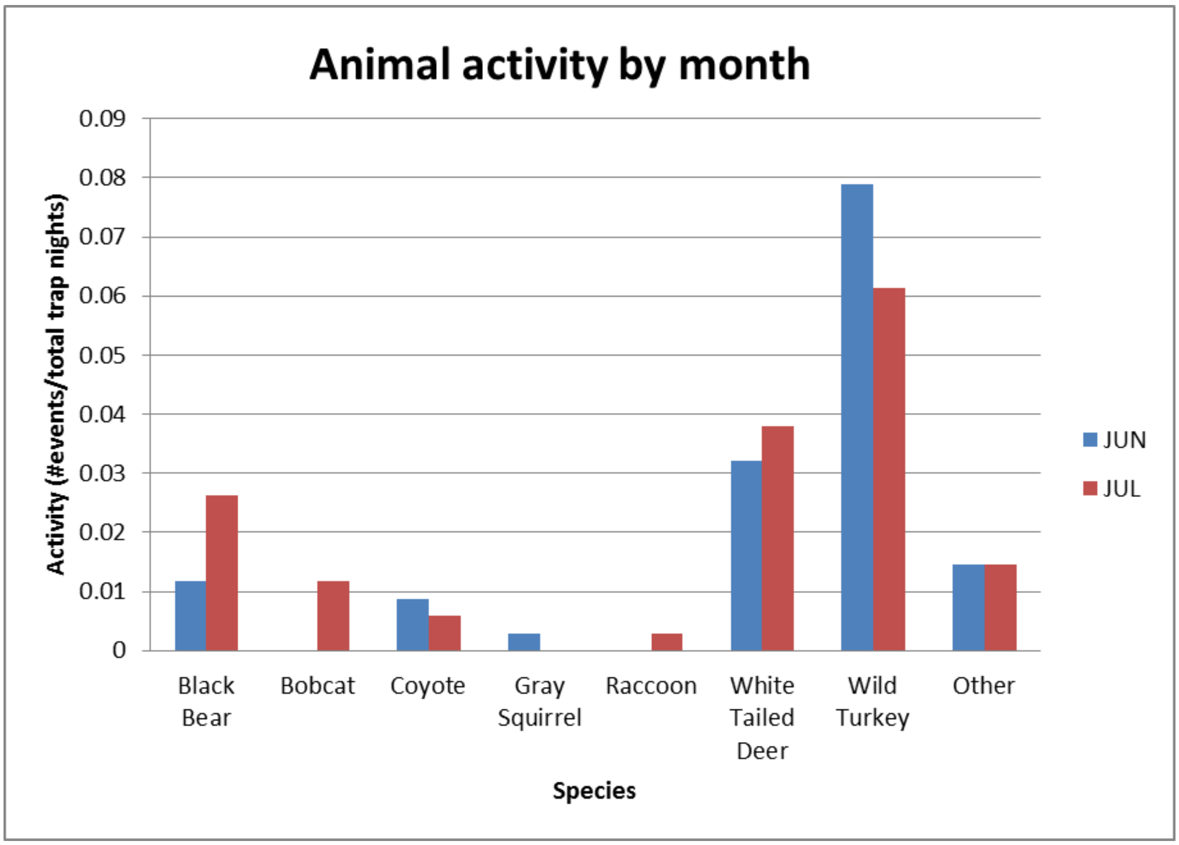

Figure 2. Animal activity by month expressed as # of independent capture events/ trap nights per station.

Arthropod sampling

Two methods were used to sample arthropods between mid-June and mid-July 2010. In pasture cover types, insects were sampled using sweep netting. A 15 cm diameter insect net was used to sample insects along a 20m transect. A total of 4 transects (one in each cardinal direction) were walked 5 times each for a total of 20 sweeps per point. After each pass with the sweep net, insects were placed in bags, labeled and placed in a freezer within 1hr of capture. After 48 hours, insects were identified to order and placed in one of 3 different size classes.

In areas where woody vegetation was present, insects were sampled using a modified version of the branch clipping method described by Johnson (2000). This method involved placing a collapsible bag over a branch and clipping it with shears. Clippings were then shaken vigorously inside the bag to dislodge insects from the vegetation. The vegetation was then removed from the bag and inspected for insects. Once the vegetation was inspected, the observer would place their head inside the bag and identify all insects to order and determine a size classes for each individual. Clippings were taken at 5m intervals along a 25m transect in each cardinal direction from each sampling point, for a total of 20 clippings per point. Two points were sampled in each of 3 cover types (Table 3).

Table 4. Arthropod sampling method and number of samples for each cover type on the Powell River Project.

Cover Type	# Samples	Sampling Method
FRA	2	Branch Clip
Traditional	2	Branch Clip
Pasture	2	Sweep Net

Expected Outcomes

Ultimately, we will obtain a better understanding of which 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 to disturbance, we hope to use our results to determine 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.

Literature Cited

ALLAIRE, P.N. 1978. Reclaimed surface mines: new potential for some North American birds. American Birds 32: 3-5.

BAJEMA, R. A., T. L. DEVAULT, P. E. SCOTT, AND S. L. LIMA. 2001. Reclaimed coal mine grasslands and their significance for Henslow's sparrows in the American Midwest. Auk 118: 422–431.

BURGER, J.A., D. GRAVES, P. ANGEL, V. DAVIS, AND C. ZIPPER. 2005. The Forest Reclamation Approach. U.S. Office of Surface Mining. Forest Reclamation Advisory number 2.

CARROZZINO, A.L. 2009. Evaluating wildlife response to vegetation restoration on reclaimed mine lands in southwestern Virginia. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, USA.
DONOVAN, T.M., AND C.H. FLATHER. 2002. Relationships among North American songbird trends, habitat fragmentation, and landscape occupancy. Ecological Applications 12: 364-374.
JOHNSON, M.D. 2000. Evaluation of an arthropod sampling technique for measuring food availability for forest insectivorous birds. Journal of Field Ornithology 71:88-109.
MICHALSKI, F. AND C.A. PERES. 2007. Disturbance-mediated mammal persistence and abundance-area relationships in Amazonian forest fragments. Conservation Biology 21: 1626-1640.
RODEWALD, A.D. 2004. Nest-searching cues and studies of nest-site selection and nesting success. Journal of Field Ornithology 75: 31-39.
ROHBAUGH AND YAHNER. 1996. Reclaimed surface mines: an important nesting habitat for Northern Harriers in Pennsylvania. Pages 307-314 *in* D.M. Bird, D.E. Varland, and J.J. Negro, editors. Raptors in human landscapes. Academic press, London, U.K.
WHITMORE, R. C. AND G. A. HALL. 1978. The response of passerine species to a new resource: reclaimed surface mines in West Virginia. American Birds 32: 6-9.
WRAY, T., K. A. STRAIT, AND R. C. WHITMORE. 1982. Reproductive success of grassland sparrows on a reclaimed surface mine in West Virginia. Auk 99: 157-164.
VAN HORNE, B. 1983. Density as a misleading indicator of habitat quality. Journal of Wildlife Management 47: 893-901.