IMPACT OF THE SURFACE MINING CONTROL AND RECLAMATION ACT ON SPECIES OF SPECIAL CONCERN IN PENNSYLVANIA[1]

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Abstract: Since the enactment of the Surface Mining Control and Reclamation Act (SMCRA) thousands of grassland habitats have been created in eastern North America. In western Pennsylvania over 50 species of birds including, eleven species that are either listed as threatened, endangered or as special concern, have been observed using grasslands and wetlands on reclaimed mines. In addition to these bird species, the endangered Massasauga (*Sistrurus catenatus catenatus*) has been observed foraging on grasslands on two mine sites in western Pennsylvania. Although the development of wildlife habitats can be incorporated into the reclamation of mine lands, the specific habitats for threatened and endangered species are generally not a defined objective of the reclamation of mine lands. Because threatened and endangered species nest and forage on grasslands and wetlands on mine lands, they should be given consideration during the reclamation of mine lands.

Additional Key Words: Threatened and Endangered Species, Grasslands, Wetlands,

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Introduction

For over 20 years, wildlife biologists have proposed using avian assemblages as indicators of the impact of habitat disturbances and reclamation of damaged ecosystems (Bradfore *et al.* 1998; Bryce *et al.* 2002; Croonquist and Brooks, 1991; Glooschenko *et al.* 1988; Severinghaus, 1981; Szaro, 1986). For example, Lugwig *et al.* (1999) reported 34 avian species using lands reclaimed with native prairie species compared with 27 and 29 species using lands reclaimed with cool seasons grasses and legumes and a Eurasian meadow dominated by meadow fescue (*Festuca elatior*), respectively. However, the use of these habitats varied among the different avian grassland species. Grasshopper sparrows (*Ammodramus savannarum*) were observed at 73% of the sampling stations in the native prairie compared with 40% and 41% of the stations in the forb/grass meadows and Eurasian grasslands, respectively. Savannah sparrows (*Passerculus sandwichensis*) preferred the prairie (41%) and Eurasian grasslands (38%). While eastern meadowlarks (*Sturnella magna*) preferred the Eurasian meadow (50%) over the forb/grass meadows (23%). Although all these species are considered to be obligate grassland birds, it appears that their habitat preference varies among the different species and similar results were reported for grassland birds, including threatened and endangered species using reclaimed mine lands and old field communities in western Pennsylvania (Rummel and Brenner, 2003 a, b).

Grasslands on reclaimed surface mines are not only beneficial to threatened and endangered birds (Brenner and Kelly 1981; Brenner and Sterner, 1988; Wray *et al*., 1978, 1982), but also may provide habitat for endangered reptiles, as well (Brenner *et al*., 1982; Brenner and Hofius, 1990). Although grasslands on reclaimed surface mines tend to be homogenous habitats, it is possible to create a variety of habitats, including those for threatened and endangered species within the confines of existing regulations (Brenner, 1986, 1990, 2000). The objective of the current study was to identify any threatened or endangered species using mine sites for some phase of their life history.

Methods

As part of a continuing study on the evaluation of wildlife habitats on surface mines in northwestern Pennsylvania, twenty five surface mines varying from 90 to 250 ha of were surveyed in a five county area for the presence of either state or federal listed threatened and endangered species that used these mine sites for some phase of their life history. All mine sites were reclaimed after 1977 using a mixture of warm season grasses and legumes creating Eurasian meadows as defined by Ludwig *et al*. (1999). The plant communities on all mine sites were dominated by blue grass (*Poa compressa*), timothy (*Phleum pretense*), fescue (*Festuca arundinacea*), white clover (*Trifolium repens*), red clover (*Trifolium pretense*), and bird's foot trefoil (*Lotus corniculatus*). At each mine site, parallel transects were located at 100m intervals across the disturbance. The number and length of the transects varied with the size of the mine site. All state or federally listed endangered species were identified as either nesting and/or foraging on the site. If species occurred in numbers to warrant the calculations of density (birds/ha), the density of these species was estimated using a line transect.

$$P = n\, f(O)/2L.$$

Where n is the number of animals sighted, L is the length of the transect and $f(O)$ is the estimated distance of sighting or vocalization from the transect line and P is the population

density (birds/ha). To avoid disturbance of the threatened or endangered species identified in this study, the locations are designated only by Township and County.

Results and Discussion

The Eastern Massasauga (*Sistrutus catenatus catenatus*) was the only endangered reptile observed foraging on reclaimed mine lands. This species was observed foraging on a mine site in the Slippery Rock Creek watershed in Cherry Township, Butler County, Pennsylvania. Another specimen of the same species was observed feeding on a mine site in the Little Sandy Creek watershed in Millbrook Township in northeastern Mercer County, Pennsylvania. Both mine sites were between 10 and 15 years of age and were located adjacent to natural wetlands. The Eastern Massasauga hibernates along the borders of wetlands and forages in upland grasslands.

The Henlow's Sparrow (*Ammodramus henslowii*) was the only endangered avian species that occurred in sufficient numbers to calculate a breeding bird density. This species was observed on 12 of the 25 mine sites with densities varying from 2 to 8 birds/ha. This species was classified as nesting species since at least one nest was observed in each of the mine sites. This species occurred on a least one mine site in all five counties in the study area. The endangered Short-eared Owl (*Asio flammeus*) was observed nesting on mine sites in Cherry Township, Butler County (1), Toby Township, Clarion (2), Washington Township, Lawrence (2) Springfield Township, Mercer (1) and Irwin Township, Venango (2) counties, Pennsylvania. The upland sandpiper (*Bartramia longicauda*) is currently listed as threatened in Pennsylvania but it may be upgraded to endangered depending on status in the on-going breeding bird survey. This species was observed nesting on mine sites in Cherry Township, Butler County (1), Toby Township, Clarion (2), Washington Township, Lawrence (1) and Springfield Township, Mercer (2) counties. Three other avian grassland species of special concern, Eastern Bluebird (*Sialis sialis*), Grasshopper Sparrow (*Ammodramus savannarum*) and Vesper Sparrow (*Pooecetes gramineus*) populations have increased in recent years and all three of these species have been observed nesting on mine lands in northwestern Pennsylvania. Although not considered a native species in Northwest Pennsylvania, the Sandhill Crane (*Grus canadensis*) has been observed feeding on reclaimed mine lands in Springfield and Sandy Lake Townships, Mercer County and Plain Grove Township, Lawrence County, Pennsylvania and a pair with young was observed in 2005 in Deer Creek Township in northeastern Mercer County.

Several endangered and threatened species were observed using wetlands that were constructed as post mining reclamation, erosion and sedimentation ponds that converted to wetlands after mine closure or last cut lakes remaining as an aftermath of mining. The state endangered King Rail (*Rallus elegans*) was observed nesting on wetland that developed on a 50 + year mine site at border of Washington Township, Lawrence and Springfield Township Mercer County, Pennsylvania. The American Bittern (*Botaurus lentiginosus*) was observed in Washington Township, Lawrence County, Pennsylvania feeding in an erosion and sedimentation pond that was converted to a wetland after mine closure. This species is currently listed a threatened in Pennsylvania, but as with the upland sandpiper, it may be upgraded to endangered once the ongoing breeding bird survey is completed. The Bald Eagle (*Haliaeetus leucocephalus*) and Osprey (*Pandion haliaetus*) were both observed feeding on a wetland located in Washington Township, Lawrence County, Pennsylvania. The Bald Eagle has recently been downgraded from endangered to threatened and the osprey was previously extirpated as a breeding species in

Pennsylvania, but is currently breeding in wetlands across the state. The American White Pelican (*Pelecanus erythrorhynchos*) was observed on a 50+ year old wetland on a mine site in Washington Township, Lawrence County, Pennsylvania. This was considered as a rare and uncommon occurrence of this Species in Northwestern Pennsylvania.

As a result of habitat fragmentation, grassland birds, including threatened and endangered species, have experienced the most severe, long-term population decline among North American birds (Brauning *et al*., 2001). The reclamation of mine lands provides an opportunity to develop and enhance habitats for a diverse array of species (Brauning et al., 1994, 2001; Brenner and Clark, 1987, Brenner and Kelly, 1982, Brenner and Hofius, 1990; Brenner and Sterner, 1988, Wray *et al*., 1978, 1982).

The endangered Henslow's (*Ammodramus henslowii*), Grasshopper (*Ammodramus savannarum*), and Savannah (*Passerculus sandwichensis*) Sparrows were common breeding species on mines 15 to 25 years following reclamation. These three species may be more habitat specific than either the Song (*Melospiza melodia*), Vesper (*Poocetes gramineus*), and Field (*Spizella pusilla*) sparrows were common breeding species on mine sites of all ages. The Dickcissel (*spiza Americana*) and Bobolink (*Dolichonyx oryzivorus*) were observed on recently reclaimed sites that were between <5 to 10 years post mining. Both of these species are declining in western Pennsylvania. They tend to prefer young grasslands but they were also observed foraging on recently mowed hay fields. Although Loggerhead Shrikes (*Landius ludovicianus*) are rare in western Pennsylvania, they were observed on a 20 year old mine site in Toby Township, Clarion County and a 30 year old mine site in Plain Grove Township, Lawrence County. Whereas, the short-eared Owl (*Asio flammeus*) was more common on younger grasslands between 5 and 15 years post mining.

The structure of grasslands on mine sites is also a factor in affecting species composition and the size and density of avian communities using these habitats (Brenner and Kelly, 1982; Chapman *et al*., 1978; Madden *et al*. 2000, Rummel and Brenner, 2003a). Chapman *et al*. (1978) reported that the number of breeding species was associated with the percentage of vegetative cover in the 0-1m layer. Likewise, Powell and Steidl (2000) indicated that the majority of nests occurred with a meter of the ground in a variety of cover types. Area coverage of vegetation has also been shown to be correlated with the abundance of grassland breeding bird populations (Rummel and Brenner, 2003a, Madden *et al*. 2000) with grasshopper sparrows having the greatest overall success on reclaimed plots with a 46% nest success (Dixon, 1978).

Many of these grassland birds especially threatened and endangered species are habitat specific, especially during the breeding season (Guerrieri *et al*., 1992; Rummel and Brenner, 2003a, b). Rummel and Brenner (2003a,b) indicated that Henslow's Sparrows may be an indicator species for evaluating the success of reclamation in terms of providing nesting cover for habitat specific bird species. The status of Henslow's Sparrows and other grassland species may depend, in part, on the extensive grasslands being created on reclaimed mine sites throughout their range (Rummel and Brenner, 2003a, b). According to Swanson (1996), Henslow's Sparrows are an area sensitive species that prefer tall, dense vegetation characteristic of unmowed, ungrazed, and unburned areas. Bajema *et al*. (2001) and Bajema and Lima (2001) concluded that grasslands on reclaimed mined lands in the Midwestern United States supported abundant populations of Henslow's Sparrows. The results of these studies suggest that reclamation efforts should strive to achieve a high degree of vegetative cover, increase the

amount of ground layer vegetation, and provide for the future development of higher vegetative strata, while delaying canopy closure as long as possible (Chapman *et al*., 1978)

Herkert *et al*. (1993) suggested that the availability of grassland habitats should include four management strategies: 1) preserve/restore large blocks of habitat, 2) create and maintain a mosaic of structure habitats, 3) remove/control woody encroachment into grasslands, and 4) manage grasslands with periodic disturbance (i.e. fire, mowing, etc.). Previous studies indicate that mowing may be detrimental to some grassland birds, including Henslow's sparrows (Brauning *et al.*, 2001; Brenner and Rummel, 2003a.b; Ingold, 2002). As beneficial as these practices may be to enhance and maintain the grassland habitats on abandoned mine lands, it may not be practical unless these lands are being managed by wildlife agencies or private conservation organizations.

Although grasslands are importance habitats for a number of threatened and endangered species, whenever possible, wetlands should be included in the overall reclamation of mine lands. As with grassland species, many threatened and endangered species identified in the current study are dependent on wetlands for either nesting or foraging habitat. For example, the state endangered Eastern Massasauga depends on both wetlands and adjacent upland grasslands for survival. Likewise, several threatened and endangered bird species including the American Bittern, King Rail, Bald Eagle and Osprey are dependent on wetlands as nesting and foraging habitats.

Conclusions and Recommendations:

Based on this and previous studies, threatened and endangered grassland and wetland avian species use mine lands as nesting and foraging habitats. Previous studies have suggested that the following set of minimal habitat requirements be used as indicators of reclamation success for mined lands: 1). the vegetation height should be at least one meter in height with a percent cover of 40-85% (Chapman *et al*. 1978; Rummel and Brenner, 2003a, b), 2) tree canopy cover of 40% or less, and 3) adequate patch size to reduce interactions between territorial species. Using GIS technology (Lauver *et al.*, 2002) as a tool in landscape ecology, the arrangement of grasslands upon the landscape can be incorporated into life history models for individual species or communities as an aid to resource mangers and planners. Although, additional studies are necessary in order to estimate the critical field size and habitat structure for threatened and endangered species. Available data suggest that a patch size of at least 50 ha and a mixture of upland habitats. Furthermore, adjacent wetlands would provide a diversity habitats for a variety of wildlife species including some that are listed threatened and endangered by state and federal wildlife agencies.

Literature Cited

Bajema, R. A., T.L. DeVault, P.E. Scott, and L. Steven. 2001. Reclaimed coal mine grasslands and their significance for Henslow's Sparrows in the American Midwest. Auk. 118:422-43. http://dx.doi.org/10.1642/0004-8038(2001)118[0422:RCMGAT]2.0.CO;2.

Bajema, R. A. and S. L. Lima. 2001. Landscape-level analyses of Henslow's Sparrows (Ammodramus henslowii) abundance in reclaimed coal mine grasslands. American Midland Naturalist. 145: 288-298. http://dx.doi.org/10.1674/0003-0031(2001)145[0288:LLAOHS]2.0.CO;2 .

Bradford, D. F., S. E. Franson, A. C. Neale, D. T. Heggem, G. R. Miller, and G. E. Canterbury. 1998. Bird assemblages as indicators of biological integrity in great basin rangeland. Environmental Monitoring and Assessment. 49:1-22.

http://dx.doi.org/10.1023/A:1005712405487.

Brauning, D. W., M. C. Brittingham, D.A. Gross, R.C. Leberman, T.L. Master, and R.S., Mulvihill.1994. Pennsylvania breeding birds of special concern: A listing rationale and status update. J. Penn. Acad. Science. 68: 3-28.

Brauning, D., M. Grishaver, and C. Grainer. 2001. Nesting-season responses of three grassland sparrow species to previous-year mowing on reclaimed surface mines in Clarion County, Pennsylvania. J. Penn. Acad. Science 75: 23-26.

Brenner, F.J. 1986. Habitat preservation and development for rare and endangered species. Pp. 53-66. In. Endangered and Threatened Species Programs in Pennsylvania and Other States: Causes, Issues and Management. Pennsylvania Academy of Science. Easton, PA.

Brenner, F.J. 1990. Mine reclamation: opportunity for critical habitat development. Pp 235-238. In. R.S. Mitchell et al. (ed). Ecosystem management: rare species and significant habitats. New York State Museum Bull. 471.

Brenner, F.J. 2000. Wildlife and fishery considerations in surface mine reclamation. *IN*: Reclamation of Drastically Disturbed Lands. American Society of Agronomy. Agronomy Monograph 41:399-413.

Brenner, F.J., and R.J. Clark. 1987. Plant species used as nest sites by passerine birds on reclaimed mine lands (Pennsylvania). Restoration. Manage. Notes 5:46-47.

Brenner, F.J. and D. Hofius. 1990. Wildlife use of mitigated wetlands on surface mined lands in western Pennsylvania. pp. 373-382. In: J. Skousen (ed). Proc. Mining Reclamation Conference. Vol. 2: West Virginia University Publication Service. Morgantown, WV

Brenner, F. J. and J. Kelly, 1981. Characteristics of bird communities on mined lands in Pennsylvania. Environmental Management. 5: 978-982. http://dx.doi.org/10.1007/BF01866821

Brenner, F.J., R. B. Kelly, and J. Kelly, 1982. Mammalian community characteristics on surface mined lands in Pennsylvania. Environmental Management. 6:214-249. http://dx.doi.org/10.1007/BF01866887.

Brenner, F. J. and B. Sterner. 1988. First year evaluation of mitigated wetlands on two mine sites in western Pennsylvania. pp 133-139. *In*. Bur. Mines Inform. Circ. 2. Proc. Conf. Mine Drainage and Surface Mine Reclamation. U.S. Depart. Of Interior, Washington D.C.

Bryce, S. A. and R. M Hughes, and P.A. Kaufmann. 2002. Development of a bird integrity index: using bird assemblages as indicators of riparian condition. Environmental Management 30:294-310. http://dx.doi.org/10.1007/s00267-002-2702-y.

Chapman, D. L., B.S. McGinnes, and R.L. Downing. 1978. Breeding bird populations in response to the natural revegetation of abandoned contour mines. Surface mining and fish/wildlife needs in the eastern United States: Proceedings of a symposium. pp 328- 332.

Note two articles were not seperated the doi is for the first one. https://doi.org/10.1007/BF02589628

Croonquist, M. J. and R. P. Brooks. 1991. Use of avian and mammalian guilds as indicators of cumul-impacts in riparian-wetland areas. Environmental Management 15:701-714 Dixon, C. L. 1978. Breeding biology of the savannah sparrow on Kent Island. Auk 95(2):235-246.

Glooschenko, V., J.H. Archbold, and D. Herman. 1988. The Ontario wetland evaluation system: replacability and bird habitat selection. In. D.D. Hook (ed). The Ecology and Management of Wetlands. 2:115-127. Timber Press, Portland, OR. http://dx.doi.org/10.1007/978-1-4615-9807-7_14.

Guerrieri, G., M. Biondi, and L. Pietrelli. 1992. Vegetational structure and bird communities in restricted ecosystems of Central Italy. Rivista Italiana di Ornitologia. 62:121-135.

Herkert, J.R., R.E. Szafoni, V. Kleen and J. F. Schwegman. 1993. Habitat establishment, Enhancement and management for forest and grassland birds in Illinois. Division of Natural Heritage, Illinois department of Natural Conservation. Natural Heritage Technical Publication #1.

Ingold, D. J. 2002. Use of a Reclaimed strip mine by grassland nesting birds in east-central Ohio. Ohio Journal of Science 102 (3):56-62.

Lauver, C. L., W. H. Busby and J. L. Whistler. 2002. Testing a GIS model of habitat suitability for a declining grassland bird. Environmental Management 30:88-97. http://dx.doi.org/10.1007/s00267-001-2609-z.

Lugwig, D. R., S. N. Kobal, J. Suchecki, and R. A. Rekau. 1999. Grassland bird use and vegetative characteristics of planted cool season and warm season fields in north-eastern Illinois. Forest preserve District of DuPage County, 12 pp.

Madden, E. M., R.K. Murphy, A. J. Hanen, and L. Murray. 2000. Models for guiding management of prairie bird habitat in northwestern North Dakota. American Midland Naturalist. 144(2): 377-392. http://dx.doi.org/10.1674/0003-0031(2000)144[0377:MFGMOP]2.0.CO;2

Powell, B.F. and R. J. Steidl. 2000. Nesting habitat and reproductive success of south-western riparian birds. Condor. 102(4):823-831. http://dx.doi.org/10.1650/0010-5422(2000)102[0823:NHARSO]2.0.CO;2Rummel, S. M. and F.J. Brenner. 2003a. Relationship between vegetation and bird populations in reclaimed grassland and native grasslands. J. Penn. Acad. Science 76: 56-61.

Rummel, S.M. and F.J. Brenner 2003b Use of grassland avian communities to monitor reclamation success on Surface mine lands. 2003 Proceedings American Society of Mining and Reclamation and 9th Billings Land Reclamation Symposium. Pp 56-68.
https://doi.org/10.21000/JASMR03010056

Schuman, G.E., 2002. Mined Land Reclamation in the northern great plains: Have we been successful. Proceedings 2002 National Meeting of the American Society of Mining and Reclamation. Lexington, KY. pp 842-865.
https://doi.org/10.21000/JASMR02010842

Severinghaus, W. D. 1981. Guild theory development as a mechanism for assessing environmental impact. Environmental Management 5:187-190.

http://dx.doi.org/10.1007/BF01873277

Surface Mining Control and Reclamation Act. 1977. Public Law 95-87.

Swanson, D.A., 1996. Nesting ecology and nesting habitat requirements of Ohio's grassland-nesting birds: A literature review. Ohio Fish and Wildlife Report. 13:3-60.

Szaro, R. 1986. Guild management: An evaluation of avian guilds as a predictive tool. Environmental Management 10:681-688. http://dx.doi.org/10.1007/BF01866772.

Wray, T., III, K. A. Stratt, and R.C. Whitmore. 1982. Reproductive success of grassland Sparrows on reclaimed surface mines in West Virginia. Auk 99: 157-168. http://dx.doi.org/10.2307/4086032.

Wray, T. III., P. B. Wackenhut, and R.C. Whitmore. 1978. The reproductive biology of Passerine birds breeding on reclaimed mines in West Virginia. pp 333-344. *In* D.E. Samuel *et al.* (eds) Surface mining and Fish/Wildlife Needs in Eastern United States. U.S. Fish and Wildlife Service. Washington, D.C.