Reclaimed Surface Mines as Avian Habitat Islands in the Eastern Forest

While not oceanic, these islands still conform to biogeographical predictions

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MacARTHUR AND WILSON'S (1967) work has rekindled an interest in island biogeography that dates back to the time of Darwin and Wallace. Numerous papers have recently appeared using insular biogeographic theory to explain bird and other species' distributions. Moreover, it has been determined that "islands" need not be oceanic and may be found in continental areas as well (*e.g.*, mountain tops, clear-cuts, forest preserves, desert oases; see Johnson 1975, Lynch and Whitcomb 1977). This led Simberloff (1974) to define an island as "any patch of habitat isolated from similar habitat by different, relatively inhospitable terrain traversed only with difficulty by organisms of the habitat patch."

West Virginia surface mining and subsequent reclamation procedures create habitat patches (islands) of grassland surrounded for the most part by hardwood forest. Largely owing to differing reclamation procedures the grasslands vary in plant species composition and density (Staples 1977). However, the usual method of reclamation is to hydroseed with an aqueous mixture of fertilizer, lime, soil stabilizers and a variety of grass and legume seeds including Tall Fescue (*Festuca arundinacea*), Birdsfoot Trefoil (*Lotus corniculatus*), Red Top (*Agrostis alba*), Timothy (*Phleum pratense*), and Oats (*Avena sativa*) (Whitmore and Hall 1978). From 1972 to 1977, 53,702 ha of new grassland were created in West Virginia. Much of this habitat type fits the above definition of an island. It is the purpose of this study to consider these habitat patches as islands and by so doing, make interpretations concerning avian density, number of species, diversity and turnover rates over a three year period of continuous study.

Study Area and Methods

BIRDS WERE CENSUSED DURING the summers of 1976-78, on several reclaimed surface mines in Preston County, West Virginia, using the territory mapping technique (Wiens 1969) The entire area of each mine was censused. Turnover rates were calculated by dividing the sum of the immigrations plus extinctions by this sum plus the number of species that persisted for the two years in question (Lynch and Whitcomb 1977). Four surface mines of varying size and age were used in

Table 1. Presence, Density and Diversity of Passerine Species Pairs Breeding on Four Reclaimed Surface Mines in Northern West Virginia, 1976-78.[1]

Species	Great Mine (1974, 41.5 ha)			Last Mine (1970, 26.6 ha)			Fur-Fin-Feather (1970, 16.5 ha)			Laurel Run (1972-73, 9.1 ha)		
	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
Horned Lark (*Eremophila alpestris*)	2	3	8	2								
Eastern Meadowlark (*Sturnella magna*)	2	1	1				3					
Red-winged Blackbird (*Agelaius phoeniceus*)			4				3	1				1
Savannah Sparrow (*Passerculus sandwichensis*)	8	9	24	2	1	1	1	2		5	2	3
Grasshopper Sparrow (*Ammodramus savannarum*)	9	12	33	8	5	5	10	8	6	11	3	
Henslow's Sparrow (*Ammodramus henslowii*)											1	
Vesper Sparrow (*Pooecetes gramineus*)	2	7	21	7	5	7	3	3	2	2	1	
Field Sparrow (*Spizella pusilla*)						1						2
Number of Species	5	5	6	4	3	4	5	4	2	3	4	3
Density (Pairs/100 ha)	55.4	77.1	219.3	71.4	41.4	52.6	121.2	84.8	48.5	197.8	76.9	65.9
Density (H)[2]	1.37	1.39	1.46	1.21	0.93	1.09	1.35	1.12	0.56	0.90	1.28	1.01

[1]Numbers underneath the name of the mine are the year of reclamation and the size in ha.

[2]Diversity values were calculated on the number of breeding pairs.

this study. The largest (47.6 ha) will be termed The Great Mine and is the most recent of the sites, being reclaimed in 1974. The Last Mine comprises 26.6 ha and was reclaimed about 1970. Another mine located on the property of The Fir, Fin, and Feather Hunting Club, was reclaimed in 1970, and totals 16.5 ha. The final site, Laurel Run (9.1 ha), was the target of an early 1970s anti-strip mine campaign which resulted in "model reclamation" between late 1972 and early 1973.

Results and Discussion

YEARLY FLUCTUATIONS IN DENSITY, diversity and number of species were pronounced (Table 1). By 1978, four years after reclamation, the largest mine had the most species, highest diversity, highest density and lowest turnover rates (Table 2) of the areas studied. Although Simberloff (1976) found no apparent relationship between island size and turnover, my results are consisted with those of most authors (*e.g.*, Diamond 1969, Lynch and Whitcomb 1977) and conform to those predicted by MacArthur and Wilson (1967). Larger islands may have more species than smaller islands for a variety of reasons, but given similar climates and distance from source populations the most likely is that there are more available patches of habitat on a larger island (Diamond 1975). The converse is also true in that small islands may lack the needed habitat patch for a certain species and, therefore, that species would not be found there. The second year after reclamation the Great Mine site supported a very limited avifauna. This was probably owing to a combination of unsuitable habitat and the fact that many potential colonists had not yet found the newly created area. As the vegetational make-up of the site improved and more birds found it, there was a more than four-fold increase in density, and general increases in species number and diversity. The generally low diversity value for all mines conforms to predictions for structurally simple habitats (MacArthur and MacArthur 1961).

Two sites, Fur, Fin and Feather and Laurel Run, showed marked decreases in species number and density. This may be owing either to vegetational change or random population fluctuations, phenomena common to small islands (Diamond 1975). At least on the small mines, the turnover rates are high, reaching 83.3% on the Laurel Run Mine (Table 2). This mine is not only the smallest but also the most isolated from areas of similar vegetation structure. Again, these results fit those predicted by the MacArthur-Wilson theory.

Table 2. Avifauna Turnover Rates Expressed as Percentages for Four Reclaimed Surface Mines in Northern West Virginia, 1976-1978.

Mine	*1976-77*	*1977-78*
Great Mine	0	16.7
Last Mine	25.0	25.0
Fur-Fin-Feather	20.0	50.0
Laurel Run	25.0	83.3

LATELY IT HAS BECOME INTERESTING to apply island theory to habitat management and conservation strategies. A highly controversial paper by Simberloff and Abele (1976) stimulated much thinking on this topic. They stated that it might be better, under certain conditions, to create many small preserves rather than a few large ones. However, Lynch and Whitcomb (1977), in a study on forest preserves, concluded that for birds there is no substitute for large (several thousand hectares) preserves of habitat if the full range of species is to be accommodated. This is based on two points. First, ". . . there appear to be no bird species which are restricted to small habitat patches, although many occur only in larger patches" and second ". . . no number of small woodlots can possibly contain all the bird species capable of breeding in larger woodlots " Their conclusion appears to be substantiated by field data collected on a variety of forest tracts censused over a period of many years.

The results of my short-term study confirm this for surface mines. At the risk of endorsing large scale environmental destruction, I conclude that properly reclaimed sites are more suited for grassland birds if they are large (>40 ha). The smaller sites are subject to high turnover, rapidly fluctuating populations and numerous extinctions. As coal has increased in value, it has become economically more feasible to surface-mine areas that previously would not have been touched. As a result, many small reclamation sites are coalescing into large tracts. This may benefit a few species that have shown recent population declines, *e.g.*, Grasshopper Sparrow. With the continual change of the habitat from forest to grassland in northern West Virginia, it may become beneficial as well as more interesting to study the grasslands as emerging continents with the remaining forest patches as islands.

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