

## ECOLOGICAL FACTORS IN MIGRATION\*

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Students of plant or animal ecology, the branch of biology dealing with environmental factors, have applied the term "endemic" to those forms of life which are confined to restricted areas. It is always interesting to make an analysis of the environmental factors of such areas, with the purpose of discovering just what factor or factors may control plant or animal distribution in the territory occupied by the endemics.

Certain plants or animals may be endemic in a very small area possessing peculiar environmental characteristics, in one section of the country, while in another the same species may be generally distributed. For example, certain plants characteristic of the northern tundra and peat bogs may be very common and have a general distribution in northern Canada, yet be endemic elsewhere, because of the almost complete absence of tundra or bog conditions.

The writer has been interested in the study of what appear to be endemic species of birds near Lynchburg, in the Virginia Piedmont. My early experience in bird study was with the birds of central and western Ohio. For the past seven years my ornithological studies have been mostly confined to the vicinity of Lynchburg. Since making the change in residence, several differences in the bird population have naturally been noted, some of which have been most pronounced when the general bird population around Lynchburg has been compared with the birds found within a restricted area known as the Edgewood Farm. This farm is located just at the southern edge of the city, in the angle between the old Salem turnpike, now better known as the Timber Lake Road, and the old Ward Road leading to Danville, now designated as U. S. Highway No. 170.

Before proceeding with a more detailed characterization of the Edgewood Farm as a bird habitat, some general comparisons of central and western Ohio with the Virginia Piedmont should be made.

Geologically, the Piedmont section is much older. Igneous and metamorphic rocks, particularly quartz, quartzite, schists, and granites, predominate. Rocks from the oldest geologic periods outcrop over much of the Piedmont. Western Ohio is younger geologically, and where surface rocks outcrop, they are of much more recent geological periods. Sedimentary rocks, such as limestone, shale, and sandstone, underlie the whole region.

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\*Read before the first annual meeting of the Virginia Society of Ornithology at Richmond, February 13, 1931.

The nature of the soils of the two regions, derived from the rocks, differs greatly. Piedmont soils are largely clay, with an abundant residue of quartzite fragments, mica, and other minerals, resulting from weathering of the country rock. The soils of western Ohio are largely loams, containing much more humus, and consequently are more fertile. Because of flatter topography, these Ohio soils are not being washed away by erosion by surface water and streams, as rapidly as is the case in the Piedmont, with its rough and sometimes mountainous topography.

Climatically also there are marked differences between the two regions. While I have no data on this point, certain facts are obvious. The average annual temperature of Virginia would be higher than that of western Ohio, and the available soil moisture in Ohio is greater than that in the Piedmont. The contrast in moisture conditions is attested by the fact that the climax forest of western Ohio is the mesophytic beech-maple forest, while that of the Piedmont is the more xerophytic oak-hickory. The available moisture in a given region may be expressed by the ratio between precipitation and evaporation for the year, and evaporation is determined by the interaction of several factors, such as sunshine, wind, and temperature, which also affect humidity.

This discussion of climate and soil differences leads up to and doubtless partially explains another fundamental difference, namely, the scarcity of meadows and grasslands in the Piedmont as compared with Ohio. On first coming to Lynchburg I noticed particularly how unusual it was to get a good sod on lawns. Later after more familiarity with the countryside, the same condition was noted with regard to farm crops. Hay and crass crops all seem scanty around Lynchburg as compared with western Ohio. This contrast is even more noticeable in the Piedmont of North Carolina.

In addition to the influence of climatic and soil or edaphic factors, the comparative scarcity of pastures and hay crops in the Piedmont is also due in large measure to different agricultural practice, though it is probably unwise to state arbitrarily whether this is effect or cause. However that may be, cultivated crops such as corn and tobacco have been grown continuously in the Piedmont from early colonial times. There has been very little stock raising or dairying.

The traveler through northern New York state is struck with the fact that grasses grow there in unusual luxuriance, producing condi-

tions in many places which ecologists refer to as natural parks. Much the same conditions characterize the Valley of Virginia or the famed blue grass regions of southwest Virginia. These sections of the state consequently have more of the species of birds that are found in grasslands.

As a result of different cultural methods, the Edgewood Farm previously mentioned seems to be an exception to the conditions described above as characterizing the Piedmont in the matter of hay and grass crops. On this farm may be found expanses of broad, grassy meadows and alfalfa fields. One can look across several hundred acres of cleared land, most of it in grass or alfalfa, without seeing the clumps of scrub pine so common elsewhere. And here are found, sometimes as residents, but principally as migrants, those species of birds common to the meadows and pastures in states to the west and north.

A list of the spring migrants found on this farm reads like a list of the breeding birds for the more open, grassy country to the north. One group of these has been found only at the Edgewood Farm. This group includes the Upland Plover, Dickcissel, Bobolink, and Savannah Sparrow.

The Upland Plover was seen on April 1, 1927, and on March 25 and April 26, 1930, I saw a pair of these birds. A single bird was seen on April 10, 1931. This species was a fairly common summer resident on upland pastures in Ohio ten or fifteen years ago. My only record for the Dickcissel for Lynchburg was made on this farm on May 27, 1927, when we saw a male and heard its song. This species is a common breeding bird in western Ohio.

The Bobolink, likewise a common breeding bird of the meadows in its summer range, selects the Edgewood Farm for its stops near Lynchburg. One male was listed there on May 18, 1928, another male on April 26, 1930, and a gay company of about fifteen males paid a brief visit on the morning of May 2, 1930. A flock of about fifty males and females was found on May 9, 1931.

Savannah Sparrows by the score stop at the height of their migration in an alfalfa field on this farm, where conditions closely simulate those of the Alleghenian life zone of northeastern Ohio, northern Pennsylvania, and New York state, where this species breeds. The song of the Savannah Sparrow was heard several times on this farm this past spring.

Another group of birds, including the Vesper Sparrow, Prairie Horned Lark, Pipit, Cowbird, and Grasshopper Sparrow, while found occasionally elsewhere than on this farm in the Lynchburg area, occur in much greater numbers here, and possibly in a few instances remain to breed.

Vesper Sparrows are present by the hundreds in the alfalfa field referred to. I have seen them in small numbers elsewhere, and should expect them to breed near Lynchburg, but have no records of their nesting. The Prairie Horned Lark, like the Vesper Sparrow, although frequently found elsewhere, may almost always be found at Edgewood Farm during the spring. This species does breed sparingly around Lynchburg. I have seen it several times during the summer, and a pair nested at the Edgewood Farm this past spring. Incidentally this appears to be the southernmost record of its nesting on the Atlantic slope.

Cowbirds stop at the farm in large flocks numbering one or two hundreds. They may be seen in much smaller flocks occasionally in other places around Lynchburg. I have no records of their breeding, but possibly a few birds remain for the summer.

The Grasshopper Sparrow, a common migrant and summer resident, is very much more abundant at Edgewood Farm than elsewhere in the Lynchburg area.

From the observations recorded above, it would appear that in this farm we have an isolated habitat, a sort of ecological island, surrounded by other and differing ecological conditions. The result is the occurrence within a restricted area of endemic species of birds, migrants and breeders, either entirely absent or found in much fewer numbers through other parts of the same general area.

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