THE IMPORTANCE OF BIRDS IN FOREST COMMUNITIES

Richard L. Plunkett[1/]

Abstract.--The usefulness of bird populations as monitors of the diversity of natural biological communities and to provide feedback to the manager as to the results of management programs is reviewed. Certain characteristics that contribute to the usefulness of birds as indicator species are discussed, and the need for reorientation toward ecosystem management in place of single-species management is stressed.

INTRODUCTION

When Richard M. DeGraaf prevailed upon me to accept this assignment, I was struck by the all-encompassing nature of the title of this paper, which is rather like the intellectual arrogance displayed by one of my professors at Northwestern University who published a book entitled simply "Man and his Works." He was an anthropologist, rather than an ecologist, which may offer an explanation though not an excuse. While it is true that ecologists are supposed to know how everything connects with everything else (Barry Commoner's First Law of Ecology), addressing this subject from a truly comprehensive standpoint lies way beyond my capabilities, and therefore I looked for a point of attack that would serve to simplify this paper and make it useful for the land manager.

One possible point of attack was that of the economic importance of birds in forest communities. The more I looked at this approach, the more difficult became the problem of how to quantify ecologic functions. That did not work.

A second point of attack would be to attempt to trace the cycling of energy through birds in forest ecosystems. Although this approach ultimately promises to be extremely useful, there is a real difficulty in drawing generalizations from the current studies that, given the present state of the art, must be restricted to relatively small plots in carefully delimited and relatively homogeneous habitats, so that this approach did not appear to offer anything of immediate practicality to the land manager.

A third point of attack would be to look at the importance of birds in forest communities in terms of their feeding ecology and its relation to insect population dynamics, perhaps examining the frequently cited role of birds in regulating the severity of outbreaks of defoliating insects. That looked promising, but when I reviewed those studies cited by Nisbet (1971), Wiens (1975) and Thomas et al. (1975), I found the evidence very much mixed. Briefly, it is apparent from those studies that birds consume only a small fraction (on the order of 1 to 7 percent, rarely as high as 14 percent) of defoliating caterpillars during the summer when insects are abundant, so that birds cannot be effective in controlling insect outbreaks in summer. Those studies also indicate, however, that birds may be capable of playing a substantial role in controlling insect populations in winter when the insects are sedentary. There are a number of studies indicating that in the winter birds may consume a much higher fraction (50 percent or more) of the insects found in a given area and thus could function to limit the number of insects emerging in the spring and hence to reduce the severity of summer outbreaks. Thus far, so good, but when I attempted to apply these findings, which are to a large measure based on European studies conducted in relatively small woodlots or on studies conducted in California and the Southwest, I noted that many of the insectivorous birds of our north central and northeastern forests are migratory and hence

1/ Staff Ecologist, National Audubon Society, 950 Third Avenue, New York, N.Y. 10022.

absent from our forests during the winter. In North America those species that depend on insects for food during the summer are the warblers, vireos, flycatchers, cuckoos, tanagers and chickadees, whereas the birds that depend on insects for food in the winter appear to be mainly the chickadees, nuthatches and woodpeckers. Where does this take us, except perhaps to emphasize the need for more intensive study of the feeding ecology of birds wintering in our forests, which may be useful but does not appear to be a particularly rewarding point of attack for this paper.

This process of elimination left me with the approach for this paper that probably springs most naturally from my own work on behalf of the National Audubon Society---that of looking at bird populations, and especially at changes in bird populations, for what they can tell us about what is happening to the habitats on which they depend. Thus what I want to suggest in the remainder of this paper is that, to the land manager, the immediate importance of birds in forest communities may lie not in any of the ways of looking at birds outlined above, but rather that it may lie in the usefulness of birds as monitors of the diversity of natural biological communities, the habitats that the land manager is charged with preserving and enhancing.

USEFULNESS OF BIRDS AS MONITORS

If one reviews the Proceedings of the Symposium on Management of Forest and Range Habitats for Nongame Birds held at Tucson, Ariz., May 6-9, 1975, one will find a common, even dominant theme running through many of the symposium papers. This is that our lack of knowledge of the complex relationships, the interconnections, the interactive pathways of trophic web organization makes it extremely difficult for the land manager to manage habitats from a sound ecological approach. Now this is a valid statement, up to a point, but what I would like to suggest is that we may well turn the equation around, that we may look to the usefulness of bird populations (and changes in them) as monitors or indicators of how well we are doing in maintaining a diversity of natural biological communities. This is a conceptual reversal, in which we say not that the land manager has to have all that information in order to make wise management decisions, but that we may look to those bird populations (and changes in them) to provide useful feedback to the land manager as to the effects (on them) of his management programs.

Now this is a function that birds have been performing for man for centuries. Perhaps the prime example is the use of the canary carried in an open cage by the miner, which functioned as an efficient early warning system for the presence of mine gases and lack of oxygen (anoxia).

In more recent times a similar function has been performed by the birds of prey and certain other species, particularly the fish-eating birds, that feed at high trophic levels in long food chains. It is no accident that we have been forced to devote so much attention to studies of the raptors in recent years, no accident that the first indications of the effects of the organochlorine insecticides and related long-lived, fat-soluble compounds were found in the larger birds of prey such as the Bald Eagle Haliaeetus leucocephalus, Osprey Pandion haliaetus and Peregrine Falcon Falco peregrinus. In each case it was the position of the species at the apex of a long food chain that gave the species its usefulness as a monitor of contamination in that food chain. I suspect that the same phenomenon can be cited to explain the relative differences we are now observing in other raptor populations, e.g., that it is probable that differences in the distribution and abundance of the Cooper's Hawk Accipiter cooperii as compared to the Sharp-shinned Hawk Accipiter striatus and the Red-shouldered Hawk Buteo lineatus as compared to the Broad-winged Hawk Buteo platypterus can be related to the size and type of prey species commonly taken by each of those raptors.

Similarly, it is partly because of their fish diet that so much attention has been devoted in recent years to the herons, egrets and ibis, the long-legged wading birds that have been doubly affected by the loss of wetland habitats and their tendency to accumulate toxins by virtue of feeding in aquatic ecosystems, and even more recently, to the gulls and terns, the short-legged wading birds that similarly serve as excellent indicators of contaminated food chains.

It might be helpful at this juncture to look at the reasons why birds are particularly useful monitors of environmental contaminants and, as I have suggested, also may serve as monitors of the diversity of natural biological communities. The class Aves has many special characteristics, including numerous adaptations necessary for flight and for specialization in feeding, but those of concern here might include the following: 2/

2/ In developing this list of those avian characteristics that make birds especially useful as monitors of environmental contaminants and the diversity of natural biological

1. Birds are conspicuous, by virtue of the fact that they are largely diurnal, for most part live above ground, and must spend a considerable portion of the daily cycle in search of food.

2. The wide range of variation in bird size, the shape of the bill, neck, wings, legs and feet, and color variation in the plumage (reflecting the fact that like man and the primates they possess color vision) permits trained observers to identify many species in the field without having to resort to collecting.

3. Many species maintain territories, which further facilitates censusing them in the field, and particularly so in the case of the songbirds where the male sings to establish and defend his territory.

4. Birds are widely distributed through nearly all known habitats; as a class the Aves have a wider distribution than any other class of terrestrial vertebrates.

5. Birds are highly mobile, which means that their populations may rather quickly respond to perturbations in their food supply or to alterations in their habitats.

6. Many bird species are migratory and store fat before migration or in preparation for winter, thus accumulating stores of lipophilic (fat-loving) toxicants, which may have a delayed effect on mortality and hence be masked by displacement in the time and place of death because they are not mobilized until the fat is burned during migration or during a period of physiological stress.

7. Birds, like men, are warm-blooded, maintaining high internal body temperatures that in turn require maintenance of high metabolic rates; this means that birds must consume large quantities of highly nutritious protein-rich foods and hence may serve as high-volume food samplers.

8. In part to meet the demands of flight, birds have an efficient external respiratory system that is designed to handle large volumes of air; thus they may also serve as high-volume air samplers.

9. Some species absorb toxicants directly through their feet and hence may be susceptible to any airborne or air-deposited toxicants that may accumulate where they perch or walk.

10. Finally, more is known about the taxonomy of birds and more work has been done on their reproductive biology, life histories, behavior and physiology than has been done for almost any other class of terrestrial vertebrate.

It should be obvious that many of the characteristics that have made birds so useful as monitors of environmental contaminants may also make birds useful as indicators of change in forest ecosystems and as monitors of diversity in natural biological communities.

A further corollary of those characteristics is that they give us the capability of censusing bird populations rapidly, perhaps more rapidly than we can census other animal populations. The techniques by which we may census bird populations in forest ecosystems have already been established, and we can draw upon several existing data banks to establish baselines and to make the other comparisons necessary to interpret what is happening to bird populations in forest communities. These include the annual Breeding Bird Survey conducted by the U.S. Fish and Wildlife Service and the Breeding Bird Census and Winter Bird Population Study organized by the National Audubon Society and published annually in American Birds. Although the Breeding Bird Survey may be somewhat skewed toward edge-inhabiting species because of its dependence on roads, the Breeding Bird Census and Winter Bird Population Study constitute long-term data acquisition programs that offer a wealth of information as to the particular habitat requirements of many of the avian species that inhabit the northeastern and north central forests, and when these data are combined with what we already know of the life histories of nearly all North American birds, we have the basis for interpretation of responses of bird populations over the past 30 to 40 years to habitat alterations resulting from succession, logging, fire, windstorm, flooding, etc. Given these sources of information, which we can draw upon for both guidance and comparison, we should be able to determine which are the most useful indicator species for each forest community. I suspect that several of the papers to be presented at this symposium will identify key indicator species for various forest communities.

---

communities, I drew heavily on an unpublished working paper, "Terrestrial vertebrate animals as biological monitors of pollution," prepared by Robert A. Lewis and Carolyn W. Lewis, Office of the Assistant Secretary for Environment, U.S. Department of Energy, Washington, D.C., as a contribution to the International Workshop on Monitoring Environmental Materials and Specimen Banking, Berlin, German Federal Republic, October 1978.

RELATION TO ECOSYSTEM MANAGEMENT

Earlier in this paper I suggested that we attempt to change our thinking, to make a conceptual reversal and focus not on how difficult it is to manage diverse habitats for nongame birds but rather to look to the bird populations themselves (and changes in them) to provide feedback as to how well or how poorly we are doing in managing forest habitats.

I also think that we need to recognize the implications of an attempt to manage forest communities for nongame birds, which is that, in order to accomplish this task without favoring one species or group of species at the expense of another, we must abandon single-species management and move toward ecosystem management.

To some extent this need to reorient our programs toward ecosystem management has been masked by other management directives that have come down the pike in recent years, most notably the requirements of the Endangered Species Act of 1973 and subsequent amendments. Just as many of us in the environmental and conservation communities were becoming aware that we could no longer practice single-species management to favor gamebirds and game animals without affecting nongame species, our attention was drawn to the need to devise special programs, based on single-species management, for endangered and threatened species. This is clearly required by the Endangered Species Act, as amended, in that any federal program or federally funded or permitted program is required by law to take into account the needs of endangered species and, in the case of federal land management agencies, to manage for them. But even this program of single-species management, however necessary, may now be approaching the point of diminishing returns as more and more endangered species are identified and listed. We have the capability for developing single-species management programs for a limited number of endangered or threatened species that occur in forest communities, but we may soon reach the point where what is necessary for one endangered species may conflict with what has to be done for another. Clearly, that point has already been reached in the Hawaiian forests, where the individual requirements of an entire assemblage of forest-dwelling endemic Hawaiian birds, all endangered, can only be met by attempting to manage the Hawaiian forest ecosystem as a unit, rather than attempting to devise separate single-species management programs for each of the endangered Hawaiian forest birds. I suspect that as we continue to develop the Endangered Species Program in North America and extend it to the flora as well as the fauna, it will become necessary to reorient that program more and more toward full ecosystem management.

There are certain other exceptions to the ecosystem management approach that spring to mind, most notably the need for special programs to meet the requirements of the birds of prey, special attention to meeting the requirements of cavity-nesting species in our forests, a high priority for the preservation of wetlands in our forest communities, and the need for special programs to deal with introduced or exotic species. Yet, if we are going to manage forest communities for nongame birds, we must, on the whole, reorient our programs from single-species management of our forests to an ecosystem approach, managing the forests for the benefit of all of their inhabitants and favoring no one group to the exclusion of another.

As my final point in this paper, I want to suggest that the only way in which we may successfully manage forest ecosystems for the benefit of nongame birds and all of their other inhabitants is to set as the principal objective of management for nongame species the maintenance of a high degree of diversity in natural biological communities. Let us return to that common theme that ran through so many of the papers at the Tucson symposium. If we accept the fact, as I believe we must, that we do, indeed, lack knowledge of all the interconnections (all of those interactive pathways of trophic web organization), we may be led to a very different conclusion: -----not that we cannot, for lack of that knowledge, manage forest communities for the benefit of nongame species, -----but that, precisely because of that lack of knowledge of all of those interconnections, we must manage for diversity, must do our best to preserve all of the elements of our forest ecosystems because we do not know enough to pick and choose among them. This is a cautious and profoundly conservative position, but it is supported by a considerable body of hypotheses and reasoning that, on the whole, suggests that diversity of natural biological communities may be our best protection against man-induced or natural perturbations of those ecosystems (Dearden 1978). This is drawn from the hypothesis----it is only a hypothesis but it is one that I find convincing---that the more diverse system, as contrasted to the less diverse system, has a greater capacity for self-restoration, precisely because it has a greater number of interconnections, interactive pathways, one or more of which may serve as the regulating and restoring mechanism.

If we take the maintenance of a high degree of diversity of natural biological communities as the principal objective of our management program for nongame birds, then the importance of birds in forest communities, to the

manager, may well be that function outlined in this paper, that of supplying the feedback that the manager requires as an indication of just how well or how poorly his management programs are doing in meeting that objective.

LITERATURE CITED

Dearden, Philip.
1978. The ecological component in land use planning: a conceptual framework. Biol. Conserv. 14:167-179.

Nisbet, Ian C. T.
1971. Trees and birds in the suburban forest. Contribution No. 84 from the Hatheway School of Conservation Education, Massachusetts Audubon Society, Lincoln, Mass. 01773. In Proceedings of the Conference of Tree Wardens, Arborists and Utilities, Amherst, Mass., p. 63-70.

Thomas, Jack W., G. L. Crouch, R. L. Bumstead and L. D. Bryant.
1975. Silvicultural options and habitat values in coniferous forests. In Proceedings of the Symposium on Management of Forest and Range Habitats for Nongame Birds, p. 272-287. USDA Forest Service Gen. Tech. Rept. WO-1.

Wiens, John A.
1975. Avian communities, energetics and functions in coniferous forest habitats. In Proceedings of the Symposium on Management of Forest and Range Habitats for Nongame Birds, p. 226-261. USDA Forest Service Gen. Tech. Rept. WO-1.