

HELMUT K. BUECHNER
and JIMMIE H. BUECHNER

EDITORS

*The Avifauna
of Northern
Latin America:
A Symposium
Held at the
Smithsonian Institution
13–15 April 1966*

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Northern Latin America

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Secretary
Smithsonian Institution

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Foreword

This conference was conceived by William Vogt, who is well known for his early concern with the ecological consequences of the human population explosion, as expressed in his book *Road to Survival* (New York: William Sloane Associates, 1948). Over three decades of field observation in Latin America have provided him with a view of environmental changes, particularly the destruction of forest vegetation, that few other scholars have experienced. The conference was convened to determine, through an exchange of information, whether the drastic modification and elimination of the wintering habitat of many breeding birds of North America may be responsible for depressed levels of populations.

The assemblage of most of the outstanding scholars of bird life in Central America, Colombia, and Venezuela at the Smithsonian Institution resulted in a remarkable accumulation of information and exchange of ideas. Fourteen individual papers were presented, each of which was followed by discussion. Further discussion took place in a plenary session after the papers on the individual countries. In lieu of resolutions the conferees agreed on a series of suggestions which are presented in these proceedings.

The conference was organized by the Smithsonian Office of Ecology, and made possible by a generous grant from the Conservation Foundation.

We would like to express our gratitude to Paul Slud, Associate Curator, Division of Birds, National Museum of Natural History, for verifying the spelling of scientific names and for his considerable assistance with the final editing.

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Prefatory Statement

S. Dillon Ripley

The idea for this conference to assess the conservation of avifauna of northern Latin America sprang from the fertile mind of William Vogt, who questioned what happens to North American migrating birds on their winter ranges in various habitats in Central America and the northern countries of South America. Controlling factors on the winter ranges, about which we have little knowledge at the present time, may be as important, if not more so, in inhibiting the population growth of these species of birds as any of the factors known to us on the summer ranges, such as the destruction of initial habitats, vast changes in secondary habitats, and intensive spraying of insecticides. Our concerns with migratory species on their north temperate ranges perhaps tend to cloud the total issue because, obviously, the birds spend a good part of their time in habitats alien to us about which we know relatively little from a biological point of view. The results of this conference help us to envision the changes occurring in Latin American habitats and to prepare our thoughts and considerations for the future.

The subject is a difficult one, but one which has been alluded to a number of times in recent literature. I remember a paper of Dean Amadon's discussing the Kirtland warbler in which he said that perhaps the limiting factor in that population was more surely its winter range, and the oceanographic and geological changes associated with that winter range, than was its summer range. I remember also discussions with

Robert MacArthur, who attempted to assess the winter ranges of warblers in which he was interested, and I remember descriptive and agonizing portrayals of the trials and tribulations of migrating warblers which Raymond A. Paynter, Jr., showed when he studied the Chinchorro and related banks off the coast of Yucatan and Quintana Roo.

When we first suggested this meeting, I think many of us who are ornithologists were rather skeptical and thought that there was not enough information, that it was premature, and that it would perhaps not be significantly helpful to have a discussion at all. The American Ornithologists Union (AOU) came to our rescue at its meeting in the summer of 1965 by adopting a resolution urging us to have such a conference, and it is partly on basis of this that we took heart and proceeded. This resolution was introduced by Victor Cahalane, and we are most grateful to him for starting this wave of positive thinking. I think that the environmental changes in northern Latin America are little realized in this country. They have been dramatic—and these changes are burned into the memories of the participants in this conference. Their impressions are recorded as the basis for ascertaining the state of our knowledge at this time. I hope that the recommendations emerging from this conference may have far-reaching influences on the conservation of avifauna in the Western Hemisphere.

The Meaning of Environment

Marston Bates

I find this a rather odd role; I never knew I would be among the birds. I have, as some of you know, spent most of my life with mosquitoes, and they are rather different. But I was thinking that I know of no kind of mosquito that would bite a man if he could find anything else, believe it or not; whereas a great many mosquitoes prefer birds, so that clearly birds deserve a good deal of respect. Anyway, when Dr. Buechner asked me to come here, I told him that I would be delighted, because at this late stage in my life I have become fascinated with birds. I solved the problem of living through winter in Ann Arbor, Michigan, a couple of years ago by building a greenhouse in which I now have a fairly good collection of hummingbirds and honeycreepers—mostly from Ecuador. You would be surprised how much better Ann Arbor looks in January when you can spend the early evening by a hibiscus bush watching an emerald hummingbird.

But obviously today I can't talk to you about birds. There is no point either in my talking about conservation—the need to preserve the diversity of the world in which we live is nowhere better appreciated than here at the Smithsonian. But what I thought might possibly be of some use is to talk about the environment in general terms, and especially to talk about some of the ways in which I have lately come to think about it. After all, what we are dealing with when we look at the avifauna—or at any other part of the living world around us—is one aspect of the environment in which our species lives.

The environment can be analyzed in all sorts of ways—the living environment, the physical environment, topographic setting, etc. But there it is—the world in which we live. “Environment”—it seems a very simple idea. It's the surroundings, the outside world. Here am I, appearing in this room. There are all of you, forming for me the present environment. There is the individual, and there is the setting. Yet the more I have thought about this the more confused I have become, and I have now reached the stage where

I really no longer know what is environment and what is not.

In part it is a problem of definition, of limits. Suppose I had an apple here and started to chew on it. When does the apple stop being in the environment and start being in me? Is it as soon as you start getting it chewed up, or is it when the biochemical processes involved in digesting the apple set in? This can, of course, be decided arbitrarily. I suspect that if you got a stomach ache from eating a green apple, even though it occurred some time later, you would still call it an environmental effect. But, as I said, this is an arbitrary matter.

Once, many years ago, I was collecting butterflies (not birds) in the Sierra Maestra mountains of Cuba when I gave birth to a large ascaris. It scared me as I hadn't known they infected people. Fortunately, I had the proper collecting equipment, so I carried the ascaris back to the Harvard Medical School. They reassured me that the ascaris had probably left because it was lonely and that I didn't need to worry. But they added further that, anyway, if you had worms, you were entitled to use the editorial “we.” Even though the worm is way down inside you, it still isn't you; it's part of the environment.

Environment, then, is at least partly a matter of source—effects depending on forces arising outside the individual are environmental. In terms of the old “nature versus nurture” controversy over the determinants of human behavior, “nurture” is environment.

When you start analyzing this situation, you soon realize that you are dealing with an interacting system. In general, the ecological vocabulary seems to me not only useless, but a positive nuisance. Its chief value is for testing the memory of students on examinations. But I do like the word “ecosystem,” because it covers nicely the series of transactions, of interactions, that occur between organisms and their setting. We now know that instead of biological communities in physical and climatic and other settings, we're dealing with

ecosystems. The kind of forest growing in a particular place is partly a consequence of the soil of that region, but the soil in turn is a consequence of the kind of forest. That is, whether the forest is pine, hardwood, or what, influences the nature of the soil. And, of course, a forest influences many details of the climate, and, the climate determines whether or not a forest can grow. So we oughtn't to talk so much about man as distinct from his environment as we are prone to do. We should think in terms of the human ecosystem—of man-environment interactions.

I sometimes get the impression that the whole world is suddenly discovering the environment and beginning to get worried about it. It may be partly Rachel Carson's fault. She was responding in *Silent Spring* to a general fear that the things we're doing to the world around us may be very bad for us in the long run—and it's no wonder that we worry about it. But I am frequently surprised at the way in which all sorts of people have become concerned with the environment. Within recent months I have been asked to talk about the environment to such diverse people as architects, city planners, and public health groups, as well as groups concerned with resources and conservation. Medicine has become very preoccupied with environmental problems. Well, we should be talking, not about the environment, but about the human ecosystem: about the interactions of people with their surroundings. But it is still convenient to try to analyze the nature of the surroundings.

Seeing Ray Fosberg in the audience reminds me of the first time I began to think like this, at another meeting in which we were discussing resources. I had been asked to talk about ways of analyzing the environment. I started out with my usual song and dance about the nature of the environment. We have, in the first place, the problem of what is total reality—what is the complete environment in which we are, say here in this room. We think we can describe it: it has lights with eggshell grills under them; walls of a certain color; soundproofing, which I see works quite well; a particular kind of seats—and we think such observations add up to a description of our surroundings. But if we had a Geiger counter here, it would go clicking away, or flashing lights, depending on what kind of counter it was, in response to shortwave parts or the electromagnetic spectrum that was hitting it. Even though we can't perceive this except by translating with an instrument, it's still here. At the other end of the spec-

trum, if we had a radio here it would be squawking—partly with sounds manufactured here in Washington, but partly also with noises from the stars or electric storms somewhere on earth. That is, these longwave parts of the electromagnetic spectrum are just as much part of the reality of this room as the narrow range that we perceive as light. This brings up the question of what parts of the total reality around us we have not found a way of translating yet. The things we know about are the things we can translate, and I wonder about what is left that we still can't translate, but that perhaps other organisms can.

This gets us to the question of the perceptual environment, that is, of the environment that the sense organs can directly intercept. I like to think about how different this is for each kind of organism; and, for that matter, how different it is for each one of us—that is, what you see, what you smell, what you hear may be quite different from my perception in the same setting. Biologists worry a good deal about anthropomorphism. But it seems to me that even more serious, from behavioral points of view at any rate, is the habit of thinking when we go into a forest, for instance, that the forest of our perceptual environment is the real forest. All you have to do is go out with your dog to get some idea of what a different forest it is for him. There are all of those delightful smells that don't mean a thing to you. Whereas, on the other hand, all the nice bright colors apparently don't mean anything to the dog. And try to imagine what the forest is to a butterfly or a squirrel. In short, the perceptual world is distinctive for each kind of organism.

There are many parts of the environment that affect us that we don't perceive. All of the outside forces that influence our behavior, perceived or not, could be grouped as the "operational environment." This room, I'm sure, is full of viruses—I brought a lot of them with me. We cannot perceive them, yet they may affect us markedly; and there are many things of that sort. Thus we have the question of total reality, the question of the things out of the total reality that have some effect on us, and then the question of things out of that complex than can be perceived.

As I have said, I was talking like this at that meeting with Ray Fosberg. There was an anthropologist there, Peter Smerdock, whom many of you may know. Pete said, "Hey Bates, have you forgot the supernatural environment?" I got to thinking back to my time in Micronesia, where there are spirits under every bush.

The spirits are terribly important because, after all, a spirit can cause a typhoon, which can wreck the whole place, whereas all a shark does, for instance, is to bite an individual—so that compared with sharks the spirits are really powerful aspects of the environment. On Ifaluk, a particular Micronesian atoll, whenever it looked as though a typhoon were blowing up, Maroligar, the number two chief, always went down to the shore and spent all day honking on a conch shell. I'm not quite sure of the theory, but I think it was to advise the spirits that we were prepared, or worried about it, or something. Whatever the theory, it always worked. No typhoons developed during the summer, and nobody but a fool would stop honking on a conch shell as long it worked like that. I often thought it was a fine example of the scientific method.

But the supernatural environment is everywhere. From our highfalutin Western point of view we can say what are the Micronesians fussing about when these spirits are something they made? Why are they scared of spirits? They have no reality. But what's reality anyway? And when you think about it, we can't talk. We may not have spirits, but we are full of ideas. They govern many of our actions—the way we live, the things we do. I think it was Ray who said, "Maybe instead of the 'supernatural environment' we ought to talk about the 'conceptual environment.'" It was Ray, I am pretty sure, who came up with that phrase first. I have been fussing around with conceptual environment ever since, and I am still very fond of the idea. I think that it illuminates what we are and what we do to a considerable degree.

We all live in a world of ideas, just as much as in a world of physical and perceptible forces. As a matter of fact, the world of ideas is often the one that controls us rather than the practicality of what we do. Look how it affects our physical relations with our surroundings. Consider this thing around my neck, my necktie, which I hate—I always feel as though I were about to be choked. Wearing this funny apparatus is a very physical fact of the immediate part of my environment—not quite so silly in Washington as it would be in the South Pacific, but still I think we could design better clothing from the point of view of comfort, if we put our minds to it. But this physical fact, this necktie, is the consequence of an idea, a consequence of our conceptual environment.

Clothing makes for particularly good illustrations; but so does housing. The other day someone—an

amputee—was fussing about why we always build houses with steps. An architect explained to me that it was a Roman tradition that still carries on. We could just as well have the doorway level—and if you had lost a leg you would appreciate this—or if we need the house raised for drainage we could have a ramp. But this very physical fact of architectural construction is a consequence of our ideas. We all know a house is supposed to have a front stoop and some steps. Or consider the use of Swiss-style steeply sloping roofs in areas where there isn't any snow to collect on the roof. In fact, the whole problem of house design is very much complicated by our ideas—many of them not rationally related to our spatial or climatic needs at all.

A few years ago I was asked to talk to the Architectural Association at Hollywood Beach, Florida. Somebody had read my book on the tropics and wanted me to discuss tropical architecture, about which, of course, I know less than I know about birds, which is little enough. Here we were, put up in the Hollywood Beach Hotel. I was taken to a very nice room overlooking the beach. But it was all sealed off. I got the bellboy to help me, and we managed to unnailed the transom. He was worried about what the management and the lady at the desk were going to say. But here we were on a lovely beach, in a hotel that had been air-conditioned. They had sealed it off from the outside so you couldn't hear the surf. You couldn't have the sea breeze blowing through your room any more. You had turned your back on the environment that you had gone south to live in. It gave me a beautiful theme to talk about. There it is—the conceptual environment again. It's easier to change the ecoclimate, to change the temperature with air-conditioning, than to get people to take off their coats and ties. It turned out, by the way, that the Hollywood Beach Hotel had a rule that you had to wear your coat and tie in the dining room. The cool-climate idea of respectability could thus be maintained in Florida.

Conceptual mechanisms of this sort, of course, also affect our attitudes toward the living world around us. Our methods of farming are largely a consequence of our conceptual environment. I'm probably a crackpot in lots of ways. Certainly one of the ways is in being irritated about imposing our Western European style of agriculture on other parts of the world. That is, we send a lot of experts from Wisconsin to Colombia or Ecuador or somewhere, and their idea is to clear off the forests and plant maize or some such kind of crop.

Then they come back and tell us how poor tropical soils are because they wash away next week. Yet this is the substrate that supports the richest, heaviest vegetation that we know of on land—that is, the rain forest. To call tropical soils poor because they do not respond to Northern agricultural techniques seems to me a prime example of a misplaced conceptual environment. The future in these rain-forest regions probably lies in tree farming. The most successful forms of tropical agriculture now are coffee plantations, banana plantations, cacao, rubber, and the like. If we can learn to use cellulose as a basic raw material for organic compounds, the rain-forest environment may prove to be the richest we have.

The conceptual environment, then, widely affects and frequently controls our relations with other organisms. And this goes a long way back into prehistory. Someone has remarked that one of the troubles with the human species is that it never solved any of the problems raised by the Neolithic revolution. With the discovery of agriculture, with the replacement of vegetation, with the beginning of man's modern role as an ecological dominant, we started to become a geological force acting on the rest of nature. We can look at food-gathering peoples essentially as part of a particular biological community; whereas we have become something that is superimposed on a community, depending on a great many differing communities for our daily needs of food and materials. In pre-Neolithic times I think man and nature were very closely related. Anthropologists tell me that in many cultures, when an animal is killed because it is needed for food, the killer apologizes for the need. It seems to me that such so-called primitive peoples are acting in ways which, though perhaps based on mythology, are still not destructive to the human ecosystem itself.

Here we are interested in the problem of man as a hunter, as an agent of extermination. That is another fascinating game—to try to classify man's relations with other organisms. There is a whole group of organisms that I would call "opportunists." I would put robins there, thistles, quite a few things—animals and plants that adapt beautifully to the human environment. Squirrels—squirrels ought to be extremely grateful for people who leave breadcrumbs out during the winter. Such organisms rejoice in the open habitat that man has created. Then there is a whole class of animals that I would call "irreconcilables," that, no matter what is done, can't get along with the human ecosys-

tem—here belongs the wolverine, as a classical example, and I suspect the passenger pigeon.

Most important here is the question of our attitudes: the kinds of organisms we regard as pests, the kinds of organisms we like to eat, the kinds of organisms we think of as repulsive, the kinds of organisms we think are cute. All of us know people who want to kill every snake they see. You can argue that this is a perfectly harmless snake that is doing a lot of good by eating rats or something, but it doesn't help; when these people see a snake they think it ought to be killed. This reaction occurs with the whole class of animals that we call "varmints." The results are equally odd if one starts to analyze what is cute. In this respect I rather like pigeons. I think pigeons are a much neglected group of animals. Here they are right under our noses, and yet just try to get a good photograph of a pigeon for a book! Aardvarks and whooping cranes and ivory-billed woodpeckers are generally easy enough, but to get a decent picture of a pigeon from our photographers is extremely difficult. If we took a census among our citizenry, we would find a division between the people who hate pigeons, like the janitors who have to clean up after them, and the people who love pigeons and feed them every day on the steps of the public library. Thus there are subgroupings in attitudes about what's repulsive and what's cute. I don't need to underline here my point that underneath all the things we will be talking about are attitudes not only toward particular species, but toward nature in general, and these attitudes are created by the conceptual environment in which we live.

When we talk about conceptual environment, we are talking about culture in the anthropological sense of the word; this in turn seems to be similar to the super-ego of the clinical psychologists though my knowledge of the clinical vocabulary is not very profound. There are, then, considerable national differences as a consequence of the differing histories of the peoples concerned. In the case of Latin America we are dealing essentially with Spanish culture, variously modified by the circumstances of the New World. It was Jaime Benitez, chancellor of the University of Puerto Rico, who first pointed out to me how much the Spanish attitude toward nature differs from that of most other European peoples. Spanish culture is essentially man-centered. This can be seen in all sorts of ways—in the lack of any great development of landscape painting, in the tendency toward formal garden

arrangement, in the relative neglect of nature reserves and parks.

A Spanish friend once told me that he thought this was because the French Enlightenment, which had so much influence on British and German thinking, had never crossed the Pyrenees. Rousseau and the other French admirers of nature and of natural man had little influence on Spanish thinking. The explanation, whatever it is, is undoubtedly complex. But my point here is to remind us that, in talking about conservation problems in Latin America, we are concerned with a conceptual environment rather different from that found in countries with Anglo-Saxon or Germanic traditions.

Jaime Benitez thought that it was important to get nature study into the primary schools in Puerto Rico so that children would get an appreciation of the natural world early in their careers. Certainly there is considerably more emphasis on nature in schools in the United States than there is in the countries to the south, though I am not at all sure how much influence this has on attitudes. It would at least be interesting to try to get ecological thinking into the schools, and to make attractive books on nature easily available.

Of course we in the United States are in no position to look down our noses at anyone else. I wish somehow that Latin America could learn from our mistakes, but nations, like people, seem to have to learn by mak-

ing their own mistakes. How nice it would be if we had saved some of the great forest that once covered Ohio. There is still a chance to save some of the great forest of the Amazon and Orinoco regions, and I hope that somehow the South American nations act effectively and in time.

But there are many problems, and they are far from peculiar to the Spanish tradition. Everywhere we have the processes of urbanization and industrialization and the overwhelming problem of rapid population growth with its pressures on the world around us. It is very difficult to be cheerful, looking at the present operation of the human ecosystem and at the deterioration of the environment. But I get some faint glimmer of hope from the idea of the conceptual environment and its importance in influencing our actions. If what we do to the environment is the consequence of our ideas, the solution of the problems is quite simple—just change our ideas. That is what all of us involved in the conservation movement are trying to do; it is what we have to do if our ecosystem is to survive. We have to be missionaries for ecological thinking. I like to go back to that old remark of Sir Francis Bacon (who seems to have said everything) that we cannot command nature except by obeying her. All we have to do is learn to live with nature instead of destroying it, lest in the process we destroy ourselves.

The Avifauna in a Changing Ecosystem

William Vogt

The squeaking wheel gets the grease and it is the large, spectacular bird—the California condor and the whooping crane—that attracts the concern of the conservationists. A rather nondescript bird like the seaside sparrow worries few people, although it has probably lost as high a percentage of its habitat during the past 25 years as any North American species. It has a range some hundreds of miles long, from Massachusetts to northern Florida, and along the Gulf Coast from Texas to peninsular Florida. At least over the northern part of its range its habitat is rarely more than a few hundred feet wide, in *Spartina* that is washed by high tides. Marinas, subdivisions, drainage ditches—the usual side effects of “progress”—are encroaching on its habitat at an increasing rate.

Many bird watchers have noted an apparent shrinkage in numbers of a variety of more familiar species and inquiries on such conspicuous birds as the bald eagle and peregrine falcon have substantiated the impression. Many of us have a feeling of a general diminution in populations of other less striking birds, based on a variety of criteria.

A neighbor of mine who spent summers for more than 50 years in the same place in the northern Catskills remembers that, as a child, she and her sister disliked whippoorwills because the beginning of their evening chorus was always a signal for the children to go to bed. During only one of the last 8 years has there been more than one pair resident within earshot of her cottage, and most years the birds have been heard only on migration.

For many years, and until at least 1939 when I left the city, nighthawks were an established part of the summer skyline above Brooklyn and parts of Manhattan; now they are almost unknown as residents.

In a hodgepodge area of well-watered, abandoned farms, second growth oak-hickory-ash-hemlock hillside, along roughly 4 miles of lane and country road in Greene County, N.Y., in the Hudson Valley, such birds

as least flycatchers, wood pewees, yellow-throated vireos, black-and-white warblers, black-throated green warblers, chestnut-sides, Louisiana waterthrushes, yellow warblers, redstarts, and indigo buntings seem uncommon, scarce or, during many recent summers, nonexistent. These are birds that 40 years ago, just across the Hudson River, I should have taken for granted in comparable vegetation. These recent observations include periods from mid May to October and, since I often work outdoors, total many hundred hours. Local populations of human beings probably do not account for the scarcity of these birds: there were fewer people in Greene County in 1960 than in 1900.

These birds are all insectivores and may well have suffered, either directly or through reduction of their food supplies, because of the pesticides that have come into increasingly wider use though there has been little local spraying.

But they are also migratory birds that spend substantial parts of the year south of the border of the United States where, with very rare exceptions, they do not receive even nominal protection. The nonmigratory cardinal population has expanded rapidly during the past 20 years.

There are over 200 species of birds that nest in the United States and migrate through Mexico, Central America, and the Caribbean. We have extraordinarily few data on their life histories during 6 or more months of the year, and fewer vital statistics. Natural selection was shaping their requirements and behavior long before Asiatic man began his limited disturbance of their habitat.

Mexico gives some protection to game birds and one can no longer buy wildfowl on the streets of the capital. The batteries or *armadas*, capable of killing dozens of waterfowl at one blast, seem to have been cleaned up, at least around Mexico City. Wild duck is no longer commonly sold in restaurants as it was in the 1940s.

Mexico has been united with Canada and our country in a migratory bird treaty and this convention, unlike many others, has to some extent been operative. Protection is reliably reported to be quite inadequate along the extensive coastal lagoons, a matter of increasing concern as roads make these more accessible and as highland lakes and marshes are drained.

On a low-altitude flight of some 150 kilometers in El Salvador, in early October 1965, most of it near the coast and part over river mouths, I saw only three flocks of birds, two of egrets and one that seemed to be ibises. During an ensuing drive of about 500 kilometers, between San Miguel, El Salvador, and Guatemala City, birds were once more notably scarce. Even the large flycatchers one expects to find along telephone wires were seen only 39 times in 70 kilometers.

In the 20 odd years since I had last visited this part of El Salvador there has been extensive felling of trees and an eightfold expansion of cotton production, chiefly in the area near the coast, along with a large increase in cocoanut and banana trees. One of the most striking phenomena during our flight was the number of small planes spraying insecticides. A significant side effect of this spraying is reported in connection with malaria control:

The geographical location of high levels of persistent malaria transmission and high DDT resistance are almost identical

They are, with few exceptions, located in the low terrain on the Pacific slope of the Isthmus of Central America. Almost without exception, they are precisely the same areas where cotton cultivation is carried on intensively, or has been at some time recently. . . . from the first of August to the end of February or even March, the cotton fields are sprayed at least once a week by aircraft using various insecticidal mixtures. DDT is one of the most common ingredients of the cocktail used . . . the larvae also live in DDT contaminated water. . . .

Resistance to DDT has appeared in *A. albimanus* in rice-growing areas in Nicaragua and the Dominican Republic where aircraft dispersal . . . is used. . . .

Subsequent visits to the Guatemalan coast near Escuintla were also notable for the apparent scarcity of birds in areas of excellent habitat such as the well-watered bird sanctuary on the finca El Salto. These low populations reinforced the concern that had led me to bring these possible scarcities to the attention of the AOU bird protection committee.

I shall try to confine my remarks to aspects of the problem of numbers and distribution of birds that will not anticipate better-founded reports of other partici-

pants in this conference. My observations will be largely limited to some profound and extensive ecological changes that have affected avian habitats and that should be obvious but that are often disregarded or forgotten.

Birds long antedate man, who probably did not arrive in the Americas before perhaps 20 or 30 thousand years ago. Except in areas of human concentration that must have had narrow ecological impact, such as central Mexico and the Mayan "empires," the habitats in which most of the birds evolved were probably little disturbed until well into the 19th century.

Concentrated human populations were never widely spread over the respective landscapes, nor are they now in most of tropical America. Soils, rainfall pattern, access to trading routes, slope and water supplies all exerted a distributive influence. As Tosi and Voertman point out, "Two formations—tropical moist and subtropical wet forest—occupy approximately 54 percent of the land area of Central America yet contain only about 10 percent of the population."

Budowski, however, observes in a later paper that "Shifting cultivation, formerly restricted to drier or colder areas, is moving into this area because of increasing population pressure."

Primitive tools were often inadequate for clearing primeval forest. Where this was sufficiently dry, fire was used—and misused. In some areas it was limited by the brief dry season. Over the region under discussion there was no destruction of the environment, except on the Mexican tableland, to parallel that around the Mediterranean, until European man arrived. The invasion of European man had an almost immediate impact. And 20th-century man can only be considered as having created an ecological upheaval.

One of the first results of European invasion was a sharp drop in the indigenous human populations. Barón Castro estimates this for El Salvador as 54 percent in 27 years. The central Mexican population, according to Cook and Simpson, probably decreased from over 10 million to 2.5 million between 1519 and 1600.

At the same time, however, as the Spaniards were reducing human competition with wildlife, chiefly through the medium of epidemics, they were introducing two changes that, today, would probably be classified as technological "progress": cattle, sheep, and goats, and the ox-drawn plow. Both the grazing animals and the tool produced permanent and degenera-

tive changes in the biological productivity of thousands of square miles, by erosion, accelerated destruction of cover, and siltation. At the same time they may have widened areas of alluvial soil and mangrove swamps and created deltas. One has only to travel through Latin America to see vast areas, once covered with vegetation, that are now essentially desert. This is not comparable to changing climax to subclimax in the Northern Hemisphere; it is virtual sterilization.

The estimates of Salgado Pérez for Mexico are comparably applicable to parts of Guatemala, El Salvador, Venezuela, and perhaps Colombia and Ecuador:

| | <i>Acres</i> | <i>Percent</i> |
|--|----------------------|----------------|
| 1. Uneroded soils such as are found in commercial forests..... | 35, 693, 215 | 10 |
| 2. Soils with incipient erosion, such as are found in humid zones, noncommercial forests, crop-bearing trees.... | 65, 115, 375 | 18 |
| 3. Moderately eroded soils such as those under irrigation and level pastures... | 76, 297, 225 | 21 |
| 4. Accelerated erosion, found on mountainous grazing land that is subject to seasonal rainfall, and uncultivated farmland..... | 157, 694, 530 | 43 |
| 5. Totally eroded soils, made up of land now uncultivated or nonproductive.. | 28, 992, 015 | 8 |
| Total..... | 363, 792, 360 | 100 |

In 1948 I quoted, without naming him, the late Franz Blom, an extraordinarily competent field anthropologist, to the effect that "Oaxaca will be a desert within 50 years." I see no reason to challenge his opinion today when, for the entire state, some 100,000 square kilometers (38,000 square miles), there are three soil conservationists. Mexico, the world's 11th largest country, with 761,000 square miles, budgets less than \$350,000 for erosion control. It may well be, however, for the region under discussion, the largest appropriation on an areal basis.

Postconquest deforestation in Mexico destroyed great stands of trees that primitive tools had been unable to injure or low population densities made unnecessary to attack. This became a serious problem, especially in mining regions, as early as 1550. Dust storms were reported as early as 1586. Humboldt, in the early 19th century, compared the "tableland of Mexico" to the "saline steppes of Asia." During this long period, however, human populations remained low, *latifundios*, or great estates, protected much land, and the destruction was probably relatively contained. An important survey of Mexican forestry law was pub-

lished in 1962. It discusses both defects in old laws and makes suggestions for new.

Reliable data on human populations are not available but again Barón Castro is probably as trustworthy as anyone. He estimates that not until about 1770 did El Salvador return to its primitive population level of 130,000, or 6 per square kilometer. This population doubled once more by about 1821, and reached 500,000 in about another 50 years. Since then the rate of increase has been climbing rapidly as in all Latin American countries except Uruguay and possibly Argentina. El Salvador now has 127 human inhabitants per square kilometer. Mexico and the Central American countries are doubling their populations in 15 to 22 years. The four Central American countries for which figures are available—Panama, Costa Rica, El Salvador, and Guatemala—have climbed from 3,308,000 in 1920 to 9,294,000 in 1962 and 1963. Total Central American population is over 13 million and within 25 years should exceed 30 million. At its present growth rate Mexico will jump from its current 40 million to 125 million by the end of the century.

Puerto Rico had a human population in 1765 of about 45,000 and a density of 5.2 per square kilometer. In 1964 there were over 2.5 million Puertorriqueños or 283 per square kilometer.

Haiti, on the direct migration route of American birds, is alleged to have 160 human inhabitants per square kilometer, and Barbados the fantastic density of 555! (The United States has about 20.)

Obviously these swelling human populations must be fed. They have few natural resources except those of the land, the exploitation of which will bring them more and more into conflict with plants and animals long established. At the present time, in the five countries that are included in the Central American Common Market, as I have pointed out elsewhere, "man requires for simple nutrition . . . some 30 billion kilocalories every day. By . . . 1990, a mere 25 years hence, some 65 billion calories" will be required. This does not take into account the need for extra protein from the scarcity of which much of the population of Central America already suffers severely. Malnutrition is probably the chief form of morbidity in these countries and production of food per capita and per hectare are both diminishing. This results from population increase, soil exhaustion and erosion, and, as was suggested by Budowski, increasing invasion of marginal lands. In view of certain population increases for some years to

come, we may expect the environmental deterioration to continue.

Governments are seemingly unconcerned with this process, since they do little or nothing to halt it; indeed, their "colonization" plans to cope with growing populations often envisage large-scale settlement on land that is highly vulnerable. Economists do most of the planning without the advice of ecologists and often without consulting soils specialists. The Alliance for Progress has acted virtually as if no such problem existed.

The destruction of habitat has been further exacerbated by a combination of land tenure that forces the small farmer onto marginal land, and by the shortening of rotational fallows as a result of population growth. Obviously, when there were only six people per square kilometer there was more land per capita than there is with 127.

Dr. Jorge Arias, President of the University of San Carlos, Guatemala, adds some significant calculations:

*Inhabitants per square
kilometer of cultivated
land (plowed permanent
crops meadows and
pastures)*

| | | |
|-------------|-------|-------|
| Country: | | |
| Guatemala | ----- | 135.9 |
| El Salvador | ----- | 148.6 |
| Honduras | ----- | 79.6 |
| Nicaragua | ----- | 88.1 |
| Costa Rica | ----- | 81.7 |

Prof. C. A. Donis, out of a wealth of experience in Africa, recently stated: "Safe estimates, provided shag is practiced in a regular diffused pattern, should fix the cultivable percentage at rarely above 75 percent and the minimum length of fallow rarely shorter than 12 years. Above 25 persons per square kilometer degradation of soils and vegetation should occur." He also notes, "When the slope of the ground is anything but gentle, and some authors note that the process starts with 3-percent slope, surface erosion of a more serious type sets in, silting up the valleys, soil fertility is gone and grass savanna installed."

There is little land of less than 3-percent slope in the area under discussion, and the poor farmers—who in Central America make up about two thirds of the total—are almost restricted to slopes that often exceed 100 percent! Bare rock is visible over large areas that formerly supported forest; where small corn patches

in others—such as hydrocarbon poisons—it may be indefensible from both the human and wildlife point

The long fallows empirically arrived at before the European imported his culture and agriculture, fallows that were possible before reduced death rates pyramided human populations upon highly vulnerable land, more or less restricted disturbances to limited zones such as tropical dry forest and subtropical moist forest. Tosi and Voertman catalogue only 250,000 square kilometers in six out of 13 natural life zones that include 434,000 square kilometers, with a low enough human density to satisfy the Donis criterion. Of course, not all agriculture here is of the shifting type, but even coffee plantations and the recently cleared cotton fields are affected by erosion and loss of fertility and increased use of insecticides.

Difficult geography, population imbalance, and primitive agriculture have been synergised into possibly nonviable dynamic process by the introduction of modern technology that is, in some ways, well fitted to the north temperate zones from which it came, while in others—such as hydrocarbon poisons—it may be indefensible from both the human and the wildlife point of view.

The ruminant and the ox-drawn plow have already been mentioned. Recently we have added the power saw, the bulldozer, insecticides and herbicides, and economic formulations that have gained considerable vogue in the "developed" countries. These last have developed a highly complex system of symbol manipulations such as paper profits, trade balances, etc., that give no weight to maintenance of productive capacity of the environment. The gross national product never includes measurements of soil fertility. The symbol manipulators, the economists, have come to have a power and influence much like that of Mayan and Aztec priests.

In one way or another they contribute to processes that destroy habitat. Some of the most devastating effects such as the drying up of marshes have a direct, disastrous impact on birds, especially stenoecious species. Euryecious species such as most of the wood warblers (*vide* Skutch) may not have suffered.

What ecological changes are doing to Kirtland's warbler on its wintering grounds in the Bahamas, where human populations are doubling in less than 20 years, should be a matter of grave concern to those concerned with perpetuation of the species.

It was reported at the recent Conference on Human Conservation in Central America that 60 percent of the energy needs of the five Common Market countries is satisfied through the use of firewood and charcoal; in El Salvador even mangrove thickets are being exploited for fuel. Unfortunately, deforestation is not only destroying wildlife habitat—it is also reducing hydroelectric potential through the erosion of watersheds and siltation of none-too-available damsites, thus helping to perpetuate the need for wood. Human population increases, obviously, tend to exaggerate this trend, especially since new technologies constantly increase their impact. There has probably never been a destructive force in Central America comparable to the Interamerican Highway.

The situation is made more difficult for many species by the fact that for the masses of the people in Latin America birds have no value except in cages or the pot. Migrants apparently contribute little to the cage-bird trade, though this has made serious inroads into the numbers of some Latin American species, such as the clarin *Myadestes* sp.); the quetzal, to some extent taken for its feathers, has probably gained no advantage by being the national bird of Guatemala.

A few years ago the president of a Central American republic was infamous, among the few local conservationists, for his predilection for dynamiting fish. He is, in a sense, the prototype of the rising middle class that does not necessarily become civilized as it accumulates even modest wealth and mobility. There has been a proliferation of small arms that are used indiscriminately for target practice as well as meat hunting. The latter pastime has long been popular, with some justification in a protein-short area, but is probably taking a significant toll. Slingshots are wielded with deadly accuracy, but whether or not they have a serious impact on bird populations I do not know. Certainly as human populations increase and more country is opened up, the pressure on birds increases. Game birds (broadly defined), both migratory and nonmigratory, and a few taken for their feathers, have been the species that have suffered most from hunting. Fortunately netting has not become widely established as it has in Italy; this is something that needs to be watched and guarded against.

The future of bird life between the Rio Bravo and Central South America is definitely dark. It is virtually certain that at no period in history have human populations been expanding with such speed and with

such a destructive technology. To continue ignoring the situation is virtually to condemn to near or complete extinction a number of species that depend on the tropical American habitats. It seems most unlikely that they can be saved without vigorous and effective effort.

It is important to remember that words themselves will not do anything effective. The Nature Protection Treaty of 1940 has been almost completely ignored. For example, though it sets park standards and provides that the boundaries of national parks are not to be altered except with legislative approval, these clauses have constantly been violated. Hundreds of thousands of acres have been turned over to squatters, lumbermen, and cattlemen. Not a single signatory has protested.

International meetings and resolutions, in themselves, have little actual effect on environments. The Interamerican Conference of the Conservation of Renewable Natural Resources of 1948 was largely worthless except to the extent that it helped to educate a few—a very few—people. Its usefulness might have been enlarged, at least as an educational tool, had the U.S. State Department kept its promise to publish its proceedings in Spanish.

It may well be too late to save some species. Without vigorous, intelligent, and informed effort many will probably be lost. If the great resources of the hemisphere—indeed, of the world, since this must also concern the IUCN and such organizations as the World Wildlife Fund—are applied it should be possible to save many species despite the apparent intention of humanity to commit suicide by overbreeding and habitat destruction. Education is critically needed and would, I am confident, be welcome.

There is room here for government negotiation and, in view of what we have tried to do to aid underdeveloped countries, here would be a relatively easy way for them to exchange the quo, if you will forgive the pun, for the millions of quid we have lent and given them. It would be little enough to ask of them, and there are various ways we might make such requests palatable, especially since it is in their own interest.

A scientific reexamination of the metabolism of pesticides in the ecosystem is obviously needed at the international level. It should probably be regionalized and not so international or technical that it will disappear into the stratosphere.

It is almost, but not quite, too late to set up national parks as part of an environmental preservation effort. They can help enormously with colonial species and perhaps with certain others permanently or seasonally sedentary, such as the quetzal and Kirtland's warbler—if the parks are large enough. They have many other justifications I need not point out to this group. But paper parks are worse than worthless.

Our government, at long last, gives some evidence that it has stopped being frightened by contraceptives, and Honduras has taken the lead among Latin American nations in beginning a national program. Some people may think there is no relationship between the condom and the cotinga; ecologists will recognize that the latter may depend on the former or an effective substitute for it. Population control should be of equal concern to conservationists as erosion control. We all have our spheres of influence and should recognize, if anyone does, that we cannot hope to save the ecosystem if we fail to control the most dynamic member of it.

There are signs that the economists have begun to acquire humility, although within the past year I have heard one exclaim he was not worried about population: the problem would be solved if left to the economists. Others, however, are seeing population growth as an economic stumbling block. Within the past year they have even begun to recognize the importance of producing enough to eat. Perhaps we can get the people who formulate policy to use real criteria such as soil fertility, healthy forests, water retention, and production of the biomass, instead of symbols that have as little relationship to the world of atoms-molecules-organisms-associations-ecosystems as the mind of the schizophrenic has to the troubling world about him.

Our way is often blocked by veritable Grand Canyons of ignorance. It should not be too difficult, given the importance of healthy ecosystems, to shift some of the men and millions from moon-dogging and National Science Foundation programs that may, of themselves, be worth fostering as a sort of intellectual caviar, but that we can ill afford, in my opinion, to a more and more crowded world that is literally melting away from beneath our feet.

Pierre Gourou makes the sage observation that "Man has interpreted the environment in terms of his techniques." Ecological understanding is showing man, everywhere, that his techniques must follow the

land, not be forced upon it. This may be beginning of wisdom that will save ecosystems and the birds that are part of it.

Discussion

ALDRICH. I am interested in the comments that once the habitat is destroyed in areas of Latin America it does not initiate a new series of ecological successional stages but rather becomes sterile. I did not get the reason for that. Why should these habitats not begin to develop another series of ecological successional stages?

VOGT. Well, I was referring to the central plateau, the parkland areas in Mexico particularly, and some areas farther south. They just seem to wash down to a sort of concrete surface—the tepetate. Certainly for a couple hundred years there has been no significant invasion of plants. These areas are bare, almost as bare as table tops. This hardpan is especially inhospitable where there are long dry seasons.

PETERSON. I might give my impressions of the northern Andes. Not long ago I was in Colombia with Carlos Lehmann. One can look at the bare slopes of the Andes and, if you do not have things explained to you, perhaps not realize (as visitors to the Hebrides in Scotland may not realize) that you are looking at landscape that probably is as modified, indeed destroyed by humans, as any landscape could be.

The main difference between an Andean forest and a forest here in the temperate zone is that when we cut down a temperate forest it eventually grows back to essentially the same kind of forest that was there before. There are a great many individual trees of relatively few species per acre in such a forest. In a tropical forest it is the reverse—there are extremely few individuals of a species per acre, but many species. Each tree has a great but shallow root system, taking trace elements from an extremely thin skin of top soil. Each tree supports a great many parasitic plants. The birds that live in such forests are numerous as to species but sparse in individuals. They must have a considerable block of forest to range about in for their survival. Their requirements are apparently just as subtle as those of the forest trees. When such a forest is cut or burned it takes an extremely long time before it comes back into the same sort of climax environment, and the birds that live there are simply knocked out. Our North American migrants, which are marginal when in the tropics, are probably not affected as much as the endemics. The endemics are the ones we must worry

about. In one concentrated week of birding in Colombia with Dr. Lehmann I saw but 1 pair of trogons, 1 pair of toucanets, and extremely few parrots—and this in a country known for its great variety in these three groups. There still are primeval areas in Colombia, but they are being destroyed with appalling rapidity. No other area on earth is experiencing quite the rapid destruction of environment that we are now witnessing in tropical America.

HOWELL. I would like to ask if there are any indigenous organizations in northern Latin America that are dedicated to the purpose of saving natural areas such as those that we have been discussing. It appears that one of the chief problems, if not the chief problem, is of course destruction of habitat. And I would like to know if there is any kind of organized movement that arises within these areas and which may or may not be supported by outside sources that might do something about this problem.

VOGT. I know of none. There is an organization called "Amigos de la Tierra" in El Salvador which has done some good work on controlling soil erosion, but it has not concerned itself with natural habitats. The only well preserved natural habitat that I know between the United States and Colombia is Barro Colorado Island, but there may be others. There may be some new organizations that I have not heard of. Mr. Phelps might know something about what is being done in Venezuela. I know they have made some progress there.

PHILLIPS. There has been an institution in Mexico for a good many years, entitled Instituto Mexicano de Recursos Naturales Renovables, which should be mentioned, although they are more concerned with educational matters such as books than with direct action.

The following statement was submitted by JAMES BOND in lieu of his verbal comments.

General Status of the Antillean Avifauna.

Early impact of human "civilization" on the avifauna of the Antilles was serious, but almost all species of birds have become adapted to changed conditions. Destruction of habitat has been an unimportant factor in respect to bird life on the volcanic islands, except in Haiti. Approximately three times as many birds became extinct from 1850 to 1920 as from 1920 to 1967, viz.: extinct between 1850–1920 *Amaurolimnas c. concolor* (Jamaica), *Amazona vittata* (Culebra), *Ara tricolor* (Cuba), *Aratinga chloroptera maugei* (Mona), *Speotyto cunicularia amaura* (St. Kitts, Nevis, Antigua),

S. c. guadeloupenensis (Marie Galante), *Siphonorhis americanus* (Jamaica), *Troglodytes aedon martinicensis* (Martinique), *Loxigilla portoricensis grandis* (St. Kitts). Extinct between 1920–1967, *Empidonax euleri johnstonei* (Grenada), *Troglodytes aedon mesoleucus* (St. Lucia), *T. a. guadeloupenensis* (Guadeloupe).

However, numerous Antillean forms that still exist are excessively rare, and some will surely become extinct within the next hundred years, viz. *Pterodroma hasitata caribbaea* (Jamaica). There are recent unverified reports of this petrel. If nesting on precipitous cliffs of the Blue and John Crow Mountains, *caribbaea* may survive for many years. *Chondrohierax uncinatus mirus* (Grenada): very few still present due to hawk shooting and, in particular, increasing scarcity of mollusks on which this kite feeds. *Amazona versicolor* (St. Lucia): range much more restricted than in 1930 due mainly to shooting and taking of nestlings. Opening of the new road between Soufriere and Micooud will enable hunters to reach the habitat of this parrot more easily. *Amazona vittata* (Puerto Rico): confined to the Luquillo National Forest. The limited population is being reduced by predation—brown rats (*Rattus norvegicus*) and pearly-eyed thrashers (*Margarops fuscatus*). *Asio flammeus portoricensis* (Puerto Rico): threatened by continued loss of suitable habitat. *Centurus superciliosus bahamensis* (Grand Bahama) and *C. s. nyeanus* (Watling's Island): have become increasingly scarce for no apparent reason. *Ramphocinclus b. brachyurus* (Martinique): apparently confined to the Presqu'île de la Caravelle. I suspect predation by *Rattus*. *Mimocichla ravidia* (Grand Cayman): has for some unknown reason been excessively rare for over 50 years. *Dendroica p. petechia* (Barbados): has been almost exterminated during the past 50 years doubtless due to parasitism by cowbirds (*Molothrus*). *Leucopeza semperi*: has been steadily on the decrease and may be extinct before the end of the century. Probably nests on or near the ground and thus suffers predation by mongooses and rats.

Shooting

For the most part there are no bag limits set for game in most of the West Indies, and where these have been imposed they are often ignored. Almost all ducks shot are North American species, but resident *Dendrocygna arborea*, *Anas bahamensis* and *Oxyura jamaicensis* have greatly decreased, particularly in the Lesser Antilles where most of the shooting is now of shore-

birds, a practice that cannot well be stopped since there is little other "game" available. No West Indian columbid is in danger of extinction from overshooting, although several species have become rare or extirpated locally.

Introduction of Exotic Species

Birds have been introduced on a number of islands, for the most part unintentionally. For example, destruction of an aviary on Tobago as a result of the 1963 hurricane has brought about the apparent establishment of at least one species (*Sicalis flaveola*) on that island. Introduction of birds on any island is apt to have a detrimental effect on native species.

GREENWAY. There is a very good organization which Ibarra runs in Guatemala. My Spanish is not good enough to pronounce it, but the Association for Protection of Nature runs a very effective organization in Guatemala for conservation.

IBARRA. Thank you, thank you indeed for your opinion about my country, Dr. Greenway. Guatemala has a few organizations concerned with fauna—protection and conservation—among them there are the Natural History Association and the lately founded Guatemalan Association for the Conservation of Nature. Of course, what we need most is a program of publicity among the scholars. We must educate in the schools in order that people have better knowledge of why we create such an organization for protecting fauna. We think that in the near future this organization will render a very good service to protect nature.

LEHMANN. I think I should state here that I completely agree with Dr. Vogt's point of view. I myself have seen many local species disappear from vast areas over the last 30 years because of the destruction of the habitat and the extensive use of pesticides through airplane spraying. Roger Peterson and I visited some areas of the Andes where very steep mountainsides have little topsoil. Farmers cut the beautiful oak woods of the forest to plant a very poor quality of corn that takes 11 months to harvest. Seemingly, the energy spent cutting the forest outweighs the value of the corn. Rains wash out the soil and leave bare rock—no succession follows. Sometimes small brush appears and crops are planted the next year. Of course in areas that are not so steep-sided other things come out—small growths of pasture and other things—but for every one of the new species that invade these areas there is an open grassland.

As for conservation, I can report that there is an international organization called Latin American Committee on National Parks that is doing extensive work in all Latin America to protect areas, and we have a big campaign with Dr. Maria Buchinger, our active executive secretary, who is working hard and helping everyone of us in our countries. In some areas, some countries are doing some work. Dr. Buchinger can give you more information about what has been done in Peru and other countries south. In Colombia we have established within the last 12 years the first reserve act of Congress, called "La Reserva de la Macarena." Two large areas are about to be established, one in the central Andes and the other one in the western Andes in Colombia called Parque Nacional de Los Farallones de Cali, that will be about 1,000 square kilometers. There is an organization called CIBITEM in Colombia, more or less like the TVA in the United States, that has charge of the development of the Magdalena and Sinú valleys. CIBITEM has selected three areas for national parks and reserves. Two are in Sierra Madre and one is on Santa Marta, which is a very important mountain in the northern part of Colombia. Another reserve is an island between the Ciénaga Grande and the Caribbean. These areas are refuges for both local and migrant birds. So something has been done. But of course I think that the main trouble is lack of education. We need more education. Dr. Vogt helped me last year in obtaining some educational films that have been of help in this program.

VOGT. I wonder what kind of budgets are provided to go with these national parks to protect them. Now Mexico has done a superb job in developing its hydroelectric and irrigation resources, but for the whole country of 761,000 square miles it has only about 1,400 forest guards, many of them without any means of transport. And the watersheds above these enormously expensive developments are just being torn down for lack of protection. I know parks in other parts of Latin America where the appropriation for protection amounts to something like 2 cents per square mile. They are paper parks; and in comparing the list of 1942 with current lists, some of the national parks just seem to have disappeared. I cannot take too much comfort at the "establishment" of these areas until I know something about the administrative facilities for protecting them and the budgets the people have to work with. And I am hoping that somehow out of

this meeting we can develop ways of stimulating that kind of support.

FOSBERG. I have been for some years rather closely associated with the Nature Conservancy in this country. I have been able to watch a phenomenon that, frankly, 15 years ago I did not anticipate at all. That has been the development of public consciousness of the idea of natural areas, in fact, public consciousness of the whole idea of ecology. Fifteen years ago the matter of natural areas seemed a completely hopeless struggle. Some of us kept at it because our conscience would not let us quit. We would not have been able to live with ourselves if we had given up. We had no idea that anything was really going to take place; but the Nature Conservancy, which then had a budget of \$500 a year and an unpaid secretary, now has many times that much. It has preserved 158 areas, ranging in size from 1 to 9,000 acres. I think that is the largest. And this is something that has recognition even at the cabinet level in the United States. Now within the last 2 or 3 years the same thing has started to happen to Latin America. I would like to hear more directly about this from Dr. Buchinger. The thing now, of course, is the urgency, since everything is happening faster than it was even 15 years ago in this country. I have the hope that this will also be true of the Nature Conservancy movement in Latin America—that will have the same acceleration that everything else seems to be governed by. I would like to hear what Dr. Buchinger has to say on this.

BUCHINGER. I would not like to speak of the things which are not yet accomplished, so perhaps I will just mention two or three of our programs which are already successfully under way. I was astonished that Carlos Lehmann did not mention one of them, but perhaps he was too modest to do so. When I came with a Guggenheim fellowship to the United States, I was studying the existing conservation organizations and realized how little was known about most of them in Latin America, and how many of them would be good examples to follow. For example, the Nature Conservancy type of organizations, which have only one objective—saving natural areas—can ask the govern-

ments to set up parks. When we established our Latin American Desk in the Nature Conservancy in the United States, we got in contact with some of our friends who we knew might be interested in establishing similar nonprofit national organizations within their countries—naturally without being branches of the Nature Conservancy in the United States. During a visit to Colombia, Carlos Lehmann showed me an area which was the last remnant of an extensive forest on the highway between Cali and Popayán. We thought that we might use this area as an example of what can be done in the way of preservation. Carlos Lehmann encouraged his friends to form a Nature Conservancy type of organization. Then we helped the Colombians get some money for the first purchase. It was not a big sum, somewhere about \$2,000; but thanks to the World Wildlife Fund and Dr. Chapman's donation a small area could be saved. It is the last refuge of about 147 species of birds. The new Nature Conservancy group got so enthusiastic about their project that within a year they doubled the terrain. The Cali group got such good publicity in the press that others followed their example. Actually, similar land-saving projects are going on in three other cities. Dr. Ibarra does similar work in Guatemala. Practically in each Latin American country a Nature Conservancy organization is already formed, or at least there are some projects on which interested conservationists are working.

As for Chile, I think you will be very pleased to hear that as of 7 months ago Chile has a minister of agriculture who is one of the greatest conservationists on the continent—he is more of a "doer" than a talker. He is trying not only to get the squatters out of the national parks but also to establish a suitable budget to train and employ wardens. Adequately trained wardens are essential; such work cannot be left to other agencies. The third interesting program is in cooperation with the *National Geographic Magazine*. Laurance Rockefeller is going to write about this new conservation movement in our hemisphere, which we hope is only a beginning for better accomplishments to follow.

Changing Abundance of Migratory Birds in North America

John W. Aldrich and Chandler S. Robbins

It is a well-known fact that many species of migratory birds have increased or decreased over the years and that many of the changes in abundance are the direct results of human activities. We wish to summarize the principal factors that contribute to these changes and to discuss briefly the means we have of detecting changes when they occur. About 400 species which breed in North America migrate to Latin America for the winter.

Since first settlement of the country by Europeans, changes in habitats of North American birds obviously have been profound. It is certain that these changes have had a very great effect on the abundance of many species of birds which nested in these habitats. Some increased, others decreased, probably largely as a result of these habitat changes. Contributing also to the drastic change in bird life in the earlier history of North American settlement was excessive exploitation of numerous species for meat and feathers. These extreme and uncontrolled causes of mortality have been greatly reduced, and managed killing for recreation and for depredation control has taken their place.

Another important factor in changing populations is competition with other species of birds, including parasitism by cowbirds. During the past two decades there has been a considerable increase in the breeding range of the brown-headed cowbird in several portions of the United States and Canada; and since this species lays its eggs in the nests of other birds, it is bound to have a significant effect on many of the small migratory species. To cite one example, Mayfield (1960), in his intensive study of the Kirtland's warbler in Michigan, found that 55 percent of the nests of this rare species are parasitized by cowbirds. He concludes that "Kirtland's warblers would produce 60 percent more fledglings if there were no cowbird interference." The cowbird was believed originally to have been a bird of the prairies, where it was associated with the bison, and

apparently it did not occur in the breeding range of the Kirtland's warbler until about 100 years ago.

The introduced starling, which has now spread all the way across the North American continent, has been an important factor in the decrease of several cavity-nesting species, such as the flickers, great crested flycatcher, and bluebirds. The introduced house sparrow, which is one of the most abundant birds over a large portion of the United States, must compete directly with many seed-eating species at times of food shortage, and it also competes for nesting sites with some of the cavity-nesting species.

Man also has changed the environment of birds quite drastically by pollution of streams, soil, and air. Efforts are being made to control this pollution. In order to rid farmlands and forests of insect pests and to protect humans from diseases and discomfort, tremendous quantities of various pesticides are used annually. Studies of the effects of a few pesticides such as DDT have been made in various parts of the country, but many wildlife losses caused by pesticides still have not been measured or evaluated.

We feel certain that great changes in abundance of birds have taken place in the past as a result of environmental changes, but until recently we have had very little documentary evidence of the magnitude of these changes. Probably no facet of the knowledge of our avifauna has been the subject of so much speculation and supported by so few facts as its numerical status. Except for a few species of game birds, there is very little usable information on the changing status of any species which breeds in North America and winters south of the United States border.

Although the Bureau of Sport Fisheries and Wildlife has been gathering information on the distribution and migration of North American birds for the past 80 years, much of the earlier information related only to time of arrival and departure and to presence or ab-

sense of a species rather than to its abundance. It is only in the past 30 years that there has been an organized effort to record the abundance of migratory birds other than waterfowl.

Starting in 1937 the National Audubon Society, with the cooperation of the Bureau of Sport Fisheries and Wildlife, encouraged ornithologists to establish study plots of from 15 to 100 acres and to determine the actual number of breeding birds in each of these study plots. In order to permit comparison between areas it was stipulated that each study plot should be of uniform habitat throughout—that is, either all pine woods, all salt marsh, or all cornfield, so that the density of each species of bird in this particular habitat could be determined. Attempts have been made to standardize procedures by use of the "Spot Mapping Method" (Williams, 1936).

When the same area is covered for a series of years it is possible to determine changes in abundance from year to year. A few areas have been covered for a decade or more and these give us information on population trends for these specific areas.

If hundreds of areas representing all of our major habitats had been censused periodically over a long period of years we would now have considerable information on population trends. Unfortunately, only 40 to 70 areas are censused in any given year and only 12 were censused both at the beginning and the end of the decade for which land-use figures were assembled. When we wish to check on changes in abundance of any given species we often find that the species for which we want information nested on only a very few of the study plots that were censused, and that our sample is so small that it is impossible to know whether a species that has decreased on the study plots has actually decreased in numbers in its overall geographic range. Generally, when an area of woodland is subsequently converted into house lots the census taker discontinues his studies and no record of the drastic change in birdlife is maintained.

The progress of bird habitat changes has been largely associated with the history of agricultural development. With the settlement of the country more and more land was cleared and planted to crops. This resulted in a decline in habitat first of forest species and then of prairie inhabitants as settlement moved westward.

The total land used for crops in the 48 contiguous states peaked at 387 million acres in 1949, but then the

trend seemed to change and by 1961 cultivated acreage had fallen off to 340 million. This decline in cultivation, of course, means that the land released from this use was converted into other types of habitat. For the most part, it would appear that this change was back to woody growth, since the acreage of forest and woodland in the 48 contiguous states of the United States increased from about 606 million in 1950 to around 640 million in 1959 (U.S. Department of Agriculture, 1953, and Wooten and Pendleton, 1962). In the eastern United States alone there was an increase in this type of land use of over 2 million acres between 1950 and 1963.

This increase in acreage of forest land becomes more significant if we break it down into the major ecological units which we are calling Life Areas, the boundaries of which are determined largely by their climax vegetation. In this way we can interpret the increase in forest in terms of its probable effect on certain species of forest-inhabiting birds, and such species make up a large majority of the land birds which migrate to Latin America.

Our best information on changing abundance of North American land birds comes from three of the principal Life Areas of North America where breeding bird censuses have been conducted over periods of years long enough to show trends. The map (fig. 1) shows the location of these Life Areas which we are calling the Eastern Deciduous Forest, the Northern Hardwood-Conifer, and the Oak-Savannah Life Areas.

The Eastern Deciduous Forest Life Area makes up all or part of 28 states in the eastern United States and a very small part of southern Ontario in Canada. It harbors such inter-American migrants as the red-eyed vireo, ovenbird, great crested flycatcher, eastern wood pewee, wood thrush, scarlet tanager, summer tanager, and hooded warbler. In 1950 there were 148,728,000 acres of wooded habitat in the U.S. portion of the Eastern Deciduous Forest Area. By 1963 this had increased to 157,861,000 (over 9 million acres).

The Northern Hardwood-Conifer Life Area comprises parts of 14 states in the eastern United States and five provinces of eastern Canada. In 1950 there were 72,741,000 acres of forest in this Life Area within the United States. By 1963 this had increased to 75,850,000 acres (over 3 million acres). It is unfortunate that no figures are available for Canada, because a very large part of the life area is in that country. Character-

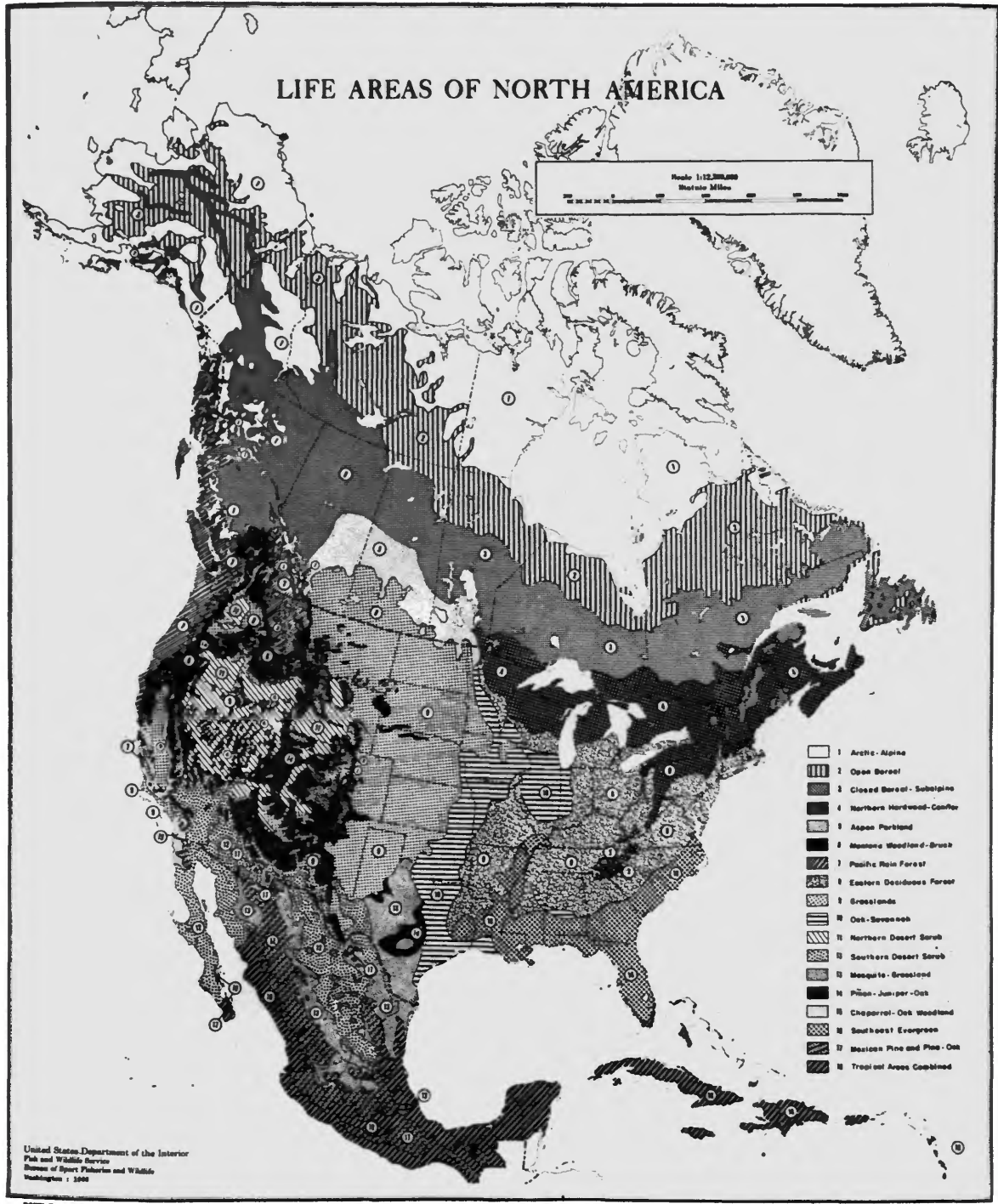


FIGURE 1.—Life areas of North America (revised from Aldrich, 1963).

istic species of birds that breed in this area and winter in Latin America are blackburnian, black-throated green, Canada, magnolia, and black-throated blue warblers, solitary vireo, veery, and least flycatcher.

The Oak-Savannah Life Area is confined to parts of 10 states in the midwestern section of the United States. It is characterized by, in addition to grassland inhabitants, such woodland types as house wren, indigo bunting, great crested flycatcher, eastern wood pewee, and yellow-billed cuckoo. In 1950 there were 55,302,000 acres of woodland in this life area and by 1963 this had decreased almost 10 million acres to 45,915,000. This decrease was largely in two states, Texas and Oklahoma, where the clearing of woody growth evidently far exceeded its increase during that period.

As noted above, despite the decrease of wooded habitat in the southern portion of the Oak-Savannah, the overall increase in forest in the eastern United States was about 2 million acres. It should be realized however, that these figures can be misleading, because at the same time the overall amount of wooded acreage was increasing, the type of growth was being changed from more mature to younger types as a result of selecting the more mature forests for cutting. This means that the abundance of breeding birds adapted to woodland types was changing. With the decrease in mature forest the abundance of most species decreases, although there is relatively little difference in the species present.

To add further to the difficulty of interpreting the effect of habitat change on birds which migrate to Latin America, there appears to have been an actual change in abundance of a few forest species unassociated with habitat change. This is indicated from analysis of the *Audubon Field Notes* "breeding bird census" data for the past 15 years. These suggest that in the relatively limited areas for which usable samples were available (12 areas totaling 375 acres) the following inter-American migrants showed a marked decrease: in the Oak-Savannah, indigo bunting; in the Eastern Deciduous Forest, ovenbird, yellowthroat, black-and-white warbler, and ruby-throated hummingbird; in the Northern Hardwood-Conifer, magnolia warbler, black-throated blue warbler, and solitary vireo. On the other hand, many more species showed no marked change and a few even slight increases. Indications of abundance considered were both numbers of areas in which increases and decreases were shown and number of individual birds involved each year. Since the total num-

ber of census areas that contained these species was so small (11 for the red-eyed vireo and fewer for all the other species), and since there was no consistent trend in populations of these species, we can only conclude that these may be indications of actual population changes.

Using quite a different census technique, Graber and Graber (1963), in a 50-year comparison of abundance of birdlife on transects covered in Illinois in 1907-9 and 1957-58, found among the woodland and wood-margin species a decrease in indigo buntings, great crested flycatchers, wood thrushes, yellowthroats, and yellow-breasted chats. It is interesting to note that indigo buntings and yellowthroats also showed a decrease in the *Audubon Field Notes* breeding bird censuses previously mentioned, whereas wood thrushes showed a slight increase.

Among the birds which breed in North America and migrate into Latin America there are a few species which have received individual and intensive study. These include the Kirtland's warbler, the golden-cheeked warbler, and the peregrine falcon. No marked decrease in either Kirtland's warbler or golden-cheeked warbler has been documented, but the potentials for a serious decrease are present on their breeding grounds. The active brush removal campaign in the Edwards Plateau region of Texas, stronghold of the golden-cheek, could result in a serious setback for this species. Fortunately, present land management seems to favor the Kirtland's warbler, which is still classed as an endangered species. Both the U.S. Forest Service and the Michigan State Department of Conservation have set aside refuge areas where the habitat is being managed specifically for optimum habitat of the Kirtland's warbler.

The peregrine falcon has shown a shocking decline in population in the more southern portions of North America, but there is no evidence that this is a result of conditions on the wintering grounds. In fact, the most migratory populations of the peregrine, those which nest in the Arctic, have shown little or no decrease in their populations. Several factors are responsible for the decline of the more southern breeding peregrines, although the relative importance of these various factors is not known. There is strong suspicion that pesticide residues in prey species have a cumulative effect on the health of adult peregrines and on hatchability of the eggs. Falconers and egg collectors made periodic raids on many of the eastern eyries and still take scores

of Arctic transients at places where they concentrate during migration. And peregrines, like most other birds of prey, continue to be shot and trapped by some farmers, hunters, and other citizens. During the past two decades there has also been a corresponding sharp decrease in many other birds of prey. No birds of prey except eagles are protected by federal law in the United States, and many states give no protection to hawks and owls.

Migratory game birds that are managed for hunting by the Canadian, Mexican, and United States governments, under terms of the migratory bird treaties between these countries, comprise a number of important inter-American migrants. These include blue-winged teal, lesser scaup, pintail, shoveler, and white-fronted goose, among the waterfowl, and also the white-winged and mourning doves and band-tailed pigeon. Although the numbers of the waterfowl vary considerably from year to year, students of their populations believe these changes can be explained almost entirely by environmental conditions on the breeding grounds. There is no indication at present that winter habitat conditions, either in the United States or south of the border, have contributed to these fluctuations. The same is true of the doves and pigeons, although less is known about the effect of winter environment, including hunting, on these species.

There are many examples of species that have disappeared from portions of their range. The cliff swallow has become very scarce east of the Appalachians. The bank swallow has almost disappeared as a breeding bird in the Central Atlantic States. The yellow-throated vireo can no longer be found in places where it used to nest in New England. Whether there has been a corresponding increase elsewhere in the breeding ranges of these species has not been documented.

As a result of stopping the killing of herons and egrets, which formerly were slaughtered in large numbers for the millinery trade, most heron species have shown a marked increase in the past few decades.

Some illegal killing of both game and nongame species continues, but efforts are continually being made to educate our citizens regarding the laws that protect our migratory birds.

As we have mentioned, a few studies have been made of total populations of individual species. For the great majority of migratory species, however, it is very difficult to find enough population data to determine trends in abundance.

The Bureau of Sport Fisheries and Wildlife is presently embarking on an extensive program to detect and measure changes in abundance of almost all species of North American birds. This breeding bird survey was tested in the states of Maryland and Delaware in the summer of 1965 and a summary of the Maryland results (Robbins, 1965) was distributed to the delegates of this conference. In June 1966 it is planned to expand this survey to include most of the eastern United States and eastern Canada. In the next 2 or 3 years the objective is to sample all of the central and western states as well.

This survey is taken primarily by qualified amateur ornithologists, who follow strict uniform rules that have been established by the Bureau of Sport Fisheries and Wildlife after several years of research on census methods. Routes are selected at random. Each route has 50 stops, one-half mile apart. The observer stops 3 minutes at each stop and counts all birds seen within one-quarter mile and all birds heard during the 3 minutes. Figure 2 shows the sheet used for recording data in the field. Starting time is standardized at one-half hour before sunrise, and it takes about 4 hours to complete coverage of a route. Except for certain check routes, each is covered only once each season. On the Maryland and Delaware routes an average of 20 birds were identified and recorded at each stop, or about 1,000 birds for each 50-stop route.

Figure 3 shows the summary sheet from which the records are put on punchcards. The first column gives the combined totals for the first 10 stops, the second column the next 10, etc. The final two columns give the total number of birds of each species and the number of stops at which the species was recorded.

Since these transects sample all important habitats, including urban and suburban areas, they should provide an estimate of the actual change in abundance of almost all species whose breeding ranges they encompass.

In addition to showing change in abundance over a period of years, this survey will permit mapping of the relative abundance of a species throughout its range and the determination of those areas of maximum abundance where preservation of habitat for a given species is most desirable. Figure 4 shows the relative abundance of the bobwhite in Maryland and Delaware based on the 1965 breeding bird survey. Although this species is nonmigratory, it will illustrate how relative abundance can be mapped throughout

Bureau of Sport Fisheries and Wildlife

BREEDING BIRD SURVEY

State M.D. Route Name BELTSVILLE Route No. P-1 Date 6/7/65 Page 1

| Stop No. | 01 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Stop No. | 01 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
|---------------------|------|----|----|----|----|----|----|----|----|----|----------------------|-----|---|---|-----|---|---|---|---|---|----|---|---|
| Starting Time | 5:13 | 17 | 22 | 26 | 31 | 35 | 40 | 45 | 50 | 57 | Starting Time | | | | | | | | | | | | |
| HERON | | | | | | | | | | | ROBIN | III | | | | | | | | | | I | |
| HERON | | | | | | | | | | | WOOD THRUSH | I | I | | | | | | | | | | I |
| DUCK | | | | | | | | | | | HERMIT THRUSH | | | | | | | | | | | | |
| TURKEY VULTURE | | | | | | | | | | | VEERY | | | | | | | | | | | | |
| BLACK VULTURE | | | | | | | | | | | E. BLUEBIRD | | | | | | | | | | | | |
| HAWK | | | | | | | | | | | BLUE-GR. GATCATCHER | | | | | | | | | | | | |
| HAWK | | | | | | | | | | | CEDAR WAXWING | | | | | | | | | | | | |
| OSPREY | | | | | | | | | | | STARLING | | | | III | | | | | | | | I |
| BOBWHITE | | | II | | | | | | | | WHITE-EYED VIREO | | | | | | | | | | | | |
| RING-NECK PHEASANT | | | | | | | | | | | YELLOW-THR. VIREO | | | | | | | | | | | | |
| RAIL | | | | | | | | | | | SOLITARY VIREO | | | | | | | | | | | | |
| KILLDEER | | | | | | | | | | | RED-EYED VIREO | | | | | | | | | | | | |
| PILOVER | | | | | | | | | | | WARBLING VIREO | | | | | | | | | | | | |
| WOODCOCK | | | | | | | | | | | BLK-AND-WHT WARBLER | | | | | | | | | | | | |
| SPOTTED SANDPIPER | | | | | | | | | | | PROTHONOTARY WARB. | | | | | | | | | | | | |
| WILLET | | | | | | | | | | | WORM-EATING WARBLER | | | | | | | | | | | | |
| SANDPIPER | | | | | | | | | | | GOLDEN-WING WARBLER | | | | | | | | | | | | |
| LAUGHING GULL | | | | | | | | | | | PARULA WARBLER | | | | | | | | | | | | |
| GULL | | | | | | | | | | | YELLOW WARBLER | | | | | | | | | | | | |
| TERN | | | | | | | | | | | MAGNOLIA WARBLER | | | | | | | | | | | | |
| MOURNING DOVE | | | | | | | | | | | BLK-THR. BLUE WARB. | | | | | | | | | | | | |
| YELLOW-BILL CUCKOO | | | | | | | | | | | BLK-THR. GREEN WARB. | | | | | | | | | | | | |
| BLACK-BILLED CUCKOO | | | | | | | | | | | CERULEAN WARBLER | | | | | | | | | | | | |
| OWL | | | | | | | | | | | BLACKBURNIAN WARB. | | | | | | | | | | | | |
| CHUCK-WILL'S WIDOW | | | | | | | | | | | YELLOW-THRO. WARB. | | | | | | | | | | | | |
| WHIP-POOR-WILL | | | | | | | | | | | CHESTNUT-SIDED WARB. | | | | | | | | | | | | |
| COMMON Nighthawk | | | | | | | | | | | PINE WARBLER | | | | | | | | | | | | |
| CHIMNEY SWIFT | | | | | | | | | | | PRAIRIE WARBLER | | | | | | | | | | | | |
| RUBY-T HUMMINGBIRD | | | | | | | | | | | OVENBIRD | | | | | | | | | | | | |
| BELTED KINGFISHER | | | | | | | | | | | LA. WATERTHRUSH | | | | | | | | | | | | |
| YELLOW-SHAFT FLICKR | | | | | | | | | | | KENTUCKY WARBLER | | | | | | | | | | | | |
| PILEATED WOODPECKER | | | | | | | | | | | YELLOWTHROAT | | | | | | | | | | | | |
| RED-BELLIED WOODP'R | | | | | | | | | | | YELLOW-BR. CHAT | | | | | | | | | | | | |
| HAIRY WOODPECKER | | | | | | | | | | | HOODED WARBLER | | | | | | | | | | | | |
| DOWNY WOODPECKER | | | | | | | | | | | CANADA WARBLER | | | | | | | | | | | | |
| E. KINGBIRD | | | | | | | | | | | AMERICAN REDSTART | | | | | | | | | | | | |
| GT CREST FLYCATCHER | | | | | | | | | | | HOUSE SPARROW | | | | | | | | | | | | |
| E. PHOEBE | | | | | | | | | | | BOBOLINK | | | | | | | | | | | | |
| ACADIAN FLYCATCHER | | | | | | | | | | | E. MEADOWLARK | | | | | | | | | | | | |
| LEAST FLYCATCHER | | | | | | | | | | | RED-WINGED BLACKBRD | | | | | | | | | | | | |
| E. WOOD PEWEE | | | | | | | | | | | ORCHARD ORIOLE | | | | | | | | | | | | |
| HORNED LARK | | | | | | | | | | | BALTIMORE ORIOLE | | | | | | | | | | | | |
| ROUGH-WING SWALLOW | | | | | | | | | | | BOAT-TAILED GRACKLE | | | | | | | | | | | | |
| BARN SWALLOW | | | | | | | | | | | COMMON GRACKLE | | | | | | | | | | | | |
| SWALLOW | | | | | | | | | | | BROWN-HEAD COWBIRD | | | | | | | | | | | | |
| PURPLE MARTIN | | | | | | | | | | | SCARLET Tanager | | | | | | | | | | | | |
| BLUE JAY | | | | | | | | | | | SUMMER Tanager | | | | | | | | | | | | |
| COMMON CROW | | | | | | | | | | | CARDINAL | | | | | | | | | | | | |
| FISH CROW | | | | | | | | | | | ROSE-BR. GROSBEAK | | | | | | | | | | | | |
| BLACK-CAP CHICKADEE | | | | | | | | | | | BLUE GROSBEAK | | | | | | | | | | | | |
| CAROLINA CHICKADEE | | | | | | | | | | | INDIGO BUNTING | | | | | | | | | | | | |
| TUFTED TITMOUSE | | | | | | | | | | | AMERICAN GOLDFINCH | | | | | | | | | | | | |
| WHITE-BR. NUTHATCH | | | | | | | | | | | RUFOUS-SIDED TOWHEE | | | | | | | | | | | | |
| BROWN-HD. NUTHATCH | | | | | | | | | | | SAVANNAH SPARROW | | | | | | | | | | | | |
| HOUSE WREN | | | | | | | | | | | GRASSHOPPER SPARROW | | | | | | | | | | | | |
| CAROLINA WREN | | | | | | | | | | | VESPER SPARROW | | | | | | | | | | | | |
| WREN | | | | | | | | | | | CHIPPING SPARROW | | | | | | | | | | | | |
| MOCKINGBIRD | | | | | | | | | | | FIELD SPARROW | | | | | | | | | | | | |
| CATBIRD | | | | | | | | | | | SWAMP SPARROW | | | | | | | | | | | | |
| BROWN THRASHER | | | | | | | | | | | SONG SPARROW | | | | | | | | | | | | |
| | | | | | | | | | | | SPARROW | | | | | | | | | | | | |

FIGURE 2.—Field record sheet for breeding bird survey.

Bureau of Sport Fisheries and Wildlife

SUMMARY SHEET, BREEDING BIRD SURVEY

State MD. Route No. P-1 Starting Locality BELTSVILLE Lat.-Long. 39°01'-76°51'

Counties (Stop numbers in each) Prince Georges (*1-28), Howard (*29-50)

Observer (Last name, then initials) ROBBINS, C. S.

Mailing Address Migratory Bird Populations Station, Laurel, Md. 20810

Weather (start & finish): Temp. 57°-76° Wind Speed, Beaufort 0-2 Sky Code 0-0

Date 6/7/65 Total Species 59 Name of Assistant, if any none

| SPECIES | ADU | PAGE TOTALS | | | | | TOTAL INDIV. | NO. OF STOPS | SPECIES | ADU | PAGE TOTALS | | | | | TOTAL INDIV. | NO. OF STOPS |
|---------------------------|------|-------------|----|----|----|----|--------------|--------------------------------|---------|-----|-------------|----|----|----|-----|--------------|--------------|
| | | 1 | 2 | 3 | 4 | 5 | | | | | 1 | 2 | 3 | 4 | 5 | | |
| GREEN HERON..... | 201 | | | | | | | CEDAR WAXWING..... | 619 | | | | | | | | |
| WOOD DUCK..... | 144 | | | | | | | LOGGERHEAD SHRIKE..... | 622 | | | | | | | | |
| TURKEY VULTURE..... | 325 | | | | | | | STARLING..... | 493 | 4 | 13 | 33 | 19 | 22 | 91 | 26 | |
| BLACK VULTURE..... | 326 | | | | | | | WHITE-EYED VIREO..... | 631 | 3 | | | | | 3 | 2 | |
| RED-TAILED HAWK..... | 337 | | | | | | | YELLOW-THR. VIREO..... | 628 | | | | | 1 | 1 | 1 | |
| RED-SHOULDERED HAWK..... | 339 | | | | | | | SOLITARY VIREO..... | 629 | | | | | | | | |
| BROAD-WINGED HAWK..... | 343 | | | | | | | RED-EYED VIREO..... | 624 | 8 | 5 | 5 | 3 | 4 | 25 | 17 | |
| OSPREY..... | 364 | | | | | | | WARBLING VIREO..... | 627 | | | | | | | | |
| SPARROW HAWK..... | 360 | | | | | | | BLK-AND-WH. WARBLER..... | 636 | 2 | | | | | 2 | 2 | |
| BOBWHITE..... | 289 | 5 | 14 | 8 | 13 | 11 | 51 | PROTONOTARY WARBLER..... | 637 | | | | | | | | |
| RING-NECK PHEASANT..... | 3091 | | | | | | 32 | WORM-EATING WARBLER..... | 639 | | | | | | | | |
| KILLDEER..... | 273 | | 2 | | | | 2 | GOLDEN-WING WARBLER..... | 642 | | | | | | | | |
| WOODCOCK..... | 228 | | | | | | | BLUE-WINGED WARBLER..... | 641 | | | | | | | | |
| SPOTTED SANDPIPER..... | 263 | | | | | | | PARULA WARBLER..... | 648 | | | | | | | | |
| WILLET..... | 258 | | | | | | | YELLOW WARBLER..... | 652 | | | | | | | | |
| LAUGHING GULL..... | 058 | | | | | | | MAGNOLIA WARBLER..... | 657 | | | | | | | | |
| MOURNING DOVE..... | 316 | 3 | 6 | 3 | 7 | 4 | 23 | BLK-THR. BLUE WARBLER..... | 654 | | | | | | | | |
| YELLOW-BELL CUCKOO..... | 387 | | | | | | | BLK-THR. GREEN WARBLER..... | 667 | | | | | | | | |
| BLACK-BILLED CUCKOO..... | 388 | | | | | | | CERULEAN WARBLER..... | 658 | | | | | | | | |
| SCREECH OWL..... | 373 | | | | | | | BLACK-BURNIAN WARBLER..... | 662 | | | | | | | | |
| GREAT HORNED OWL..... | 375 | | | | | | | YELLOW-THR. WARBLER..... | 663 | | | | | | | | |
| BARRED OWL..... | 368 | | | | | | | CHESTNUT-SIDED W. WARBLER..... | 659 | | | | | | | | |
| CHUCK-WILL'S-WIDOW..... | 446 | | | | | | | PINE WARBLER..... | 671 | | | | | | | | |
| WHIP-POOR-WILL..... | 417 | | | | | | | PRAIRIE WARBLER..... | 673 | 2 | 2 | | | | 4 | 3 | |
| COMMON NIGHT-HAWK..... | 420 | | | | | | | DYEBIRD..... | 674 | 2 | | | | | 2 | 2 | |
| CHIMNEY SWIFT..... | 423 | 7 | 7 | 3 | 11 | | 29 | NO. WATERTHRUSH..... | 675 | | | | | | | | |
| RUBY-T HUMMINGBIRD..... | 428 | | | | | | | LA. WATERTHRUSH..... | 676 | | | | 1 | | 1 | 1 | |
| BELTED KINGFISHER..... | 390 | | | | | | | KENTUCKY WARBLER..... | 677 | | | | | | | | |
| YELLOW-SHAFT FLICKER..... | 412 | | | | | | 3 | YELLOW THROAT..... | 681 | 1 | 2 | | | | 4 | 4 | |
| PILEATED WOODPECKER..... | 405 | | | | | | 3 | YELLOW-BR. CHAT..... | 683 | 2 | 1 | | | | 4 | 4 | |
| RED-BELLIED WOPKR..... | 409 | | | | | | 4 | HOODED WARBLER..... | 684 | | | | | | 1 | 1 | |
| HAIRY WOODPECKER..... | 393 | | | | | | 4 | CANADA WARBLER..... | 686 | | | | | | | | |
| DOWNY WOODPECKER..... | 394 | | | | | | 2 | AMERICAN REDSTART..... | 687 | | | | | | 1 | 1 | |
| E. KINGBIRD..... | 444 | 2 | 1 | 1 | | | 4 | HOUSE SPARROW..... | 6882 | 6 | 9 | 8 | 7 | 5 | 34 | 20 | |
| GT CREST FLYCATCHER..... | 452 | | | | | | 2 | BOBOLINK..... | 494 | | | | | | 1 | 1 | |
| E. PHOEBE..... | 456 | | | | | | 1 | E. MEADOWLARK..... | 501 | 1 | 3 | 3 | 11 | 16 | 34 | 20 | |
| ACADIAN FLYCATCHER..... | 465 | | | | | | 1 | RED-WINGED BLKBRD..... | 498 | | | | 9 | 26 | 36 | 16 | |
| TRAIL'S FLYCATCHER..... | 466 | | | | | | 1 | ORCHARD ORIOLE..... | 506 | | | | | | 1 | 2 | |
| LEAST FLYCATCHER..... | 467 | | | | | | 10 | BALTIMORE ORIOLE..... | 507 | | | | | | 1 | 1 | |
| E. WOOD PEWEE..... | 461 | 2 | 4 | 2 | 1 | | 10 | BOAT-TAIL GRACKLE..... | 513 | | | | | | | | |
| HORNED LARK..... | 474 | | | | | | 1 | COMMON GRACKLE..... | 511 | 17 | 15 | 16 | 31 | 37 | 116 | 31 | |
| TREE SWALLOW..... | 614 | | | | | | | BROWN-ND. COWBIRD..... | 495 | 2 | 1 | 1 | | | 4 | 5 | |
| BANK SWALLOW..... | 616 | | | | | | | STARLE TANAGER..... | 608 | 3 | 4 | 1 | | | 9 | 9 | |
| ROUGH-WING SWALLOW..... | 617 | | | | | | | SUMMER TANAGER..... | 610 | | | | | | | | |
| BARN SWALLOW..... | 613 | 2 | 4 | 2 | 7 | 13 | 28 | CARDINAL..... | 593 | 6 | 4 | 7 | 4 | 3 | 24 | 20 | |
| CLIFF SWALLOW..... | 612 | | | | | | | ROSE-BR. GROSBEAK..... | 595 | | | | | | | | |
| PURPLE MARTIN..... | 611 | | | 2 | | | 2 | BLUE GROSBEAK..... | 597 | | | | | 1 | 3 | 3 | |
| BLUE JAY..... | 477 | 2 | 2 | 4 | 5 | | 13 | INDIGO BUNTING..... | 598 | 1 | 5 | 5 | 7 | 3 | 21 | 18 | |
| COMMON CROW..... | 488 | 14 | 3 | 1 | 2 | 5 | 25 | AMERICAN GOLDFINCH..... | 529 | | | | 1 | 3 | 2 | 6 | |
| FISH CROW..... | 490 | 2 | | | | | 3 | RUFOUS-SIDED TOWNESE..... | 587 | 15 | 3 | 2 | 2 | 1 | 23 | 17 | |
| BLACK-CAP CHICKADEE..... | 735 | | | | | | | SAVANNAH SPARROW..... | 542 | | | | | | | | |
| CAROLINA CHICKADEE..... | 736 | | | 2 | | | 3 | GRASSHOPPER SPARROW..... | 546 | | | | 3 | 5 | 10 | 10 | |
| TUFTED TITMOUSE..... | 731 | 7 | 2 | 2 | 3 | 1 | 15 | HENSLOW'S SPARROW..... | 547 | 2 | | | | | | | |
| WHITE-BR. NUTHATCH..... | 727 | | | | | | | SHARP-TAILED SPARROW..... | 549 | | | | | | | | |
| BROWN-HEADED NUT..... | 729 | | | | | | | SEASIDE SPARROW..... | 550 | | | | | | | | |
| HOUSE WREN..... | 721 | | 2 | 4 | 4 | 1 | 11 | VESPER SPARROW..... | 540 | | | | | | | | |
| CAROLINA WREN..... | 718 | | | | | | | SLATE-COL JUNCO..... | 567 | | | | | | | | |
| LONG-BIL MARSH WREN..... | 725 | | | | | | | CHIPPING SPARROW..... | 560 | 2 | 4 | 6 | 4 | 3 | 19 | 17 | |
| MOCKINGBIRD..... | 703 | 7 | 9 | 14 | 7 | 8 | 45 | FIELD SPARROW..... | 563 | 4 | 7 | 6 | 2 | | 19 | 15 | |
| CATBIRD..... | 704 | 3 | 7 | 3 | 3 | | 16 | SWAMP SPARROW..... | 584 | | | | | | | | |
| BROWN THRASHER..... | 705 | 3 | 3 | 1 | 3 | | 10 | SONG SPARROW..... | 581 | 2 | 3 | 6 | 5 | 9 | 25 | 21 | |
| ROBIN..... | 761 | 4 | 9 | 14 | 13 | 11 | 51 | | | | | | | | | | |
| WOOD THRUSH..... | 755 | 6 | 6 | 1 | 2 | 1 | 16 | | | | | | | | | | |
| HERMIT THRUSH..... | 759 | | | | | | | | | | | | | | | | |
| VEERY..... | 756 | | | | | | | | | | | | | | | | |
| E. BLUEBIRD..... | 766 | | | | | | | | | | | | | | | | |
| BLUE-GR Gnatcatcher..... | 751 | | | | | | | | | | | | | | | | |

FIGURE 3.—Summary sheet of records taken from field sheets for breeding bird survey.

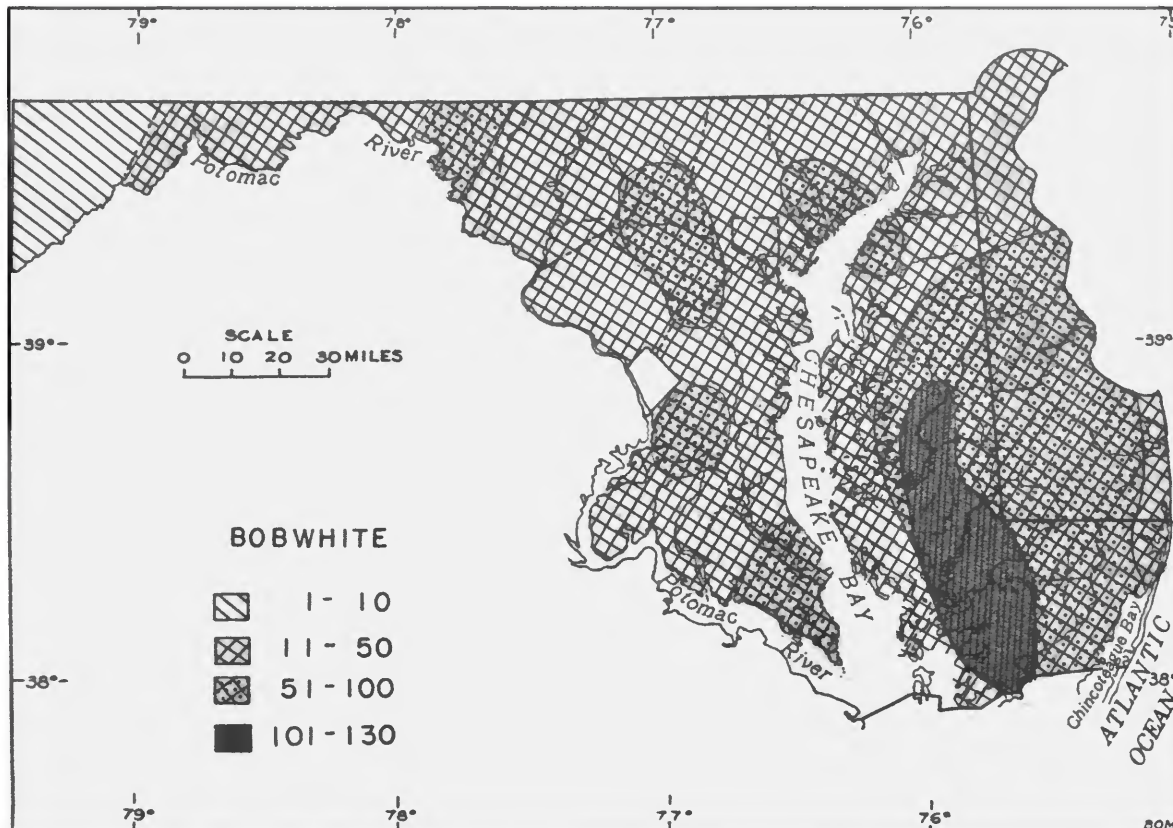


FIGURE 4.—Relative abundance of the bobwhite quail in Maryland from the 1965 breeding bird survey.

a state, a nation, or a continent. The actual mapping will be programmed through a UNIVAC computer in such a way that the totals for a given species for each route will be printed in their proper places on a large map of the North American continent.

The breeding bird survey does not measure the actual population; it merely samples it. Nor does it compare the abundance of one species with the abundance of another species. A large or a noisy species is more easily noticed by the observer than is a small or quiet species. In time, correction factors can be worked out to adjust for the differences in conspicuousness. However, the principal objectives of detecting changes in abundance and of mapping relative abundance can be accomplished without these correction factors.

The greatest variable factor on the breeding bird survey is the observer. This variable was checked on the Maryland and Delaware counts by requiring each participant to cover one check route in addition to the

other routes covered. All check routes were also run by the same Bureau employee, so the performance of each observer could be compared with the performance of every other observer. Daily changes over the same route when covered by the same observer also were studied.

We believe that this survey will be a big step forward in documenting population changes of our migratory birds. Only by recognizing changes as they occur can we take the necessary steps to provide protection at the times and places where it is most needed.

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Discussion

PETERSON. How far apart are the check points on the census?

ROBBINS. One-half mile.

PETERSON. That I find about right. I have been using that on woodcock surveys at night and you can be about sure you are not duplicating the same birds. Of course your (Chan Robbins) ears are particularly sharp. You would assume that half a mile is about right, wouldn't you?

ROBBINS. Well, of course, certain species you can hear a long distance. You take something like a pheasant or a bobwhite and you will hear it beyond the limit. That is true—but each species will be sampled uniformly.

PETERSON. There is certainly an enormous difference between your ears and most ears, and even those of the best birdwatchers.

ROBBINS. You would be surprised how closely these counts agree when you get a lot of people covering the same area. There are certain standard differences; but as far as recording species is concerned, on a route where the average is about 60 species, you will find that almost everyone of the people we used on the survey found between 55 and 65 species. You have differences in the concentration of different observers. I may rely more on my ears, while somebody else who does not hear quite as much or as far may be recording more birds he has seen. While I am missing chimney swifts, I will be picking up distant red-eyed vireos or something like that.

PETERSON. Then, of course, there is the difference in ears with age. After 15 years an observer's blackburnian warbler's voice may drop out of his register. What do you do about that?

ROBBINS. That is one reason we have to select our observers carefully, Roger. We know that this is going to happen. We, of course, want to keep the same observers to reduce the variability and yet it is very true that with most people the high frequency calls are going to drop out. I think that over a period of years the inevitable turnover in observers is going to be sufficient so that the number of blackburnian warblers recorded will not decrease seriously as a result of inability to hear the song.

PETERSON. I think it is a wonderful project—one that will give us some of the data we need. We need such data before we really can talk with authority about some of these things.

PHILLIPS. You do not want to forget from that map that you put up on the board there, that this technique is very fine when applied to a *level* area with very little ecological variability like Maryland. But when you start to apply it to Arizona, or any other mountainous western state, your results are going to depend entirely on what particular type of habitat you happen to get going in.

ROBBINS. This is very true. But, of course, all of our starting points are determined at random. I ran routes last summer in the Rockies west of Denver up to Loveland Pass in the high country above timber line. My randomly selected route just happened to go through the pass. We do have difficulty in finding roads in certain places, but it is still possible to get a sample which is much more representative than anything that we have been able to achieve in the past. And while we do have problems with availability of roads, and problems with traffic, we have certain rules whereby we try to avoid being near the main highways. There are no habitats that potentially could not be sampled by this method. On the Loveland Pass route we turned up a white-tailed ptarmigan. So you cannot say we do not sample a particular habitat. Theoretically, we can sample everything. It is only the habitats that are very local and very poorly distributed that will be poorly sampled.

PETERSON. Do you have a timespan within the days when you are to do it? Because that could be critical.

ROBBINS. Coverage of each route starts exactly one-half hour before sunrise. It takes approximately 4 hours

to complete the 50 stops. This gets most of the routes covered before there is a very big drop in the singing of the birds; and if there is a drop this shows up on our summary sheets where we report everything by series of 10 stops. Birds such as the wood thrush will show up high in the first 10 stops then drop down low for the others. So if we want to compare only the first 10 stops we can do this. It is very easy to do.

SHORT. I noticed that the species which seem to show a decrease are edge species like the indigo bunting and the yellowthroat. I suspect that this is true. The

reasons for it are probably to be found in the agricultural history of farm abandonment earlier in the century, and the subsequent growing up of woodlands. Agricultural land which is used, say in central New York with which I am familiar, is used more intensively. The land released from use has grown up into woodland, thus diminishing edge habitat for these birds. Also the draining of swamps and the resultant decrease in edge habitat around such wet areas may be a factor in their decline.

Natural Vegetation and Reservation Prospects in Northern Latin America

L. R. Holdridge

Because of a broad diversity in climate, physiography, and soils, northern Latin America, comprising Middle America, Colombia, and Venezuela, is one of the richest biological regions on our planet. Coincidentally, it is predominantly a sector of small nations and of rapid demographic growth. Truly, within this region we face an immediate and severe challenge to find effective ways and means to maintain an adequate sample of this rich biological heritage for the future.

Within northern Latin America, the true tropical region extends northwards to mid-Nicaragua on the mainland and to the passage between Martinique and Dominica in the Windward Islands. The subtropical region, characterized by a significantly wider annual range of temperatures as well as by less complex and less exuberant vegetative growth, continuous northward to include the southern tip of Florida, the Bahamas, and the Bermudas, while on the continent it gives way to the warm temperate region in northern Mexico. As the latter region extends into the southern United States, it will not be mentioned further in the present paper.

Complete sets of altitudinal belts from sea level to perpetual snow and ice may be found in both the tropical and subtropical regions of the area, comprising seven belts in both Colombia and Venezuela in the former region and six belts in Mexico in the latter.

Mean annual precipitation covers a wide range in both regions. As an example, in Colombia alone, rainfall averages vary from about 200 mm. to over 10,000. By subdivision of the precipitation ranges in the altitudinal belts of each region into natural life zone units, one obtains a rough estimate of the relative diversity of the flora and fauna in each nation. As a few examples, Colombia has 23 life zones, Costa Rica 12, Guatemala about nine, and Puerto Rico five.

Each life zone may comprise several distinct associations due to edaphic and local climatic or atmospheric

factors. Edaphic conditions which produce different associations range from waterlogged swamps or highly fertile alluvial and recent volcanic soils to excessively drained terrain of shallow soils over limestone or infertile pumice or laterite soils. Local subclimatic or atmospheric conditions such as the monsoonal Pacific coastal region of Central America or cloud belts give rise to other distinctive associations.

This brief sketch of the ecological diversity in northern Latin America has been presented to provide a basis for an understanding of the changes in natural conditions effected by man's activities in the past and of those to be expected with the rapidly increasing population pressure.

Man has found and still finds the most suitable conditions for agriculture and habitation along or close to the unity line of potential evapotranspiration ratio. The unity line corresponds to where the precipitation which enters the earth is equal in quantity to the water which moves upward in the soil for evaporation and transpiration. In essence, permanent agriculture is most feasible near the unity line because soil fertility is not excessively leached downward into streams nor concentrated at the surface in saline soils. Also, living is more pleasant due to the absence of excessive humidity or drought.

Thus, the natural vegetation in the moist and dry humidity provinces bordering the unity line is the first to be removed by man in any region. In northern Latin America, it is now very difficult to find any appreciable natural mature forests on fertile lands of gentle or flat terrain within these two rows of life zones. Even on poorer soils or broken topography, land use within these climates has been heavy in grazing or shifting agriculture. Furthermore, these life zones with sufficient humidity for considerable herbaceous growth together with generally severe dry seasons con-

stitute the areas where fire causes heavy damage to vegetation and wildlife.

Toward drier conditions, agriculture becomes more difficult and precarious except on irrigated areas. Although agricultural use is generally lighter on sloping lands, the vegetation is less complex and slower growing, so that the effects of any disturbance are long enduring. Due to the predominance of hard, dense woods, such forests in northern Latin America have been heavily exploited for firewood, posts, and railway ties over a long period. The net result today in areas drier than the subhumid is an almost complete lack of mature or virgin vegetation, but, at the same time, a persistence of considerable areas of heavily disturbed natural vegetation. Fires have been a less destructive factor in the semiarid and drier areas due to the greater scarcity of combustible ground vegetation.

Until recently, disturbance of the natural vegetation in the provinces of the Wet and Rain Forest life zones has been much less severe. The major portion of our remaining virgin or mature natural forests is to be found in these climates. Only in the last decade or two has there been a significant movement to convert these less desirable zones to agricultural use. Experience to date indicates that man can develop permanent prosperous agricultural settlements within these life zones only on alluvial plains and recent volcanic soils. Because sloping lands in these areas lose their fertility rapidly, early attempts at land use are often those of temporary shifting cultivation with the areas being invaded rapidly with second-growth stands. On steep slopes where high rainfall is normal, however, long-term damage or site destruction may occur, as these photographs taken by Dr. J. A. Tosi in Costa Rica show so clearly [not reproduced]. Fires, with the exception of monsoonal associations, are ordinarily not a severe problem.

By this subdivision of the regions and altitudinal belts into three broad groupings of humidity provinces one can more readily visualize the future changes to be effected by man and better orient any program of preservation of natural areas.

In the Wet and Rain Forest life zones, there still remain extensive areas of natural vegetation with its associated fauna. Population pressure is being directed increasingly into such regions. However, if effective action is taken within the next few years tracts of appreciable size may still be preserved.

In semiarid and drier life zones the existing status of considerable acreage in heavily disturbed natural vegetation should not change appreciably for several decades. Good-sized tracts can still be acquired which, with adequate protection, would slowly return to their original natural condition.

Heaviest pressure has been and will continue to be exerted in the intermediate moist and dry life zones. Within these two humidity provinces, attempts to preserve any remaining natural areas must be carried out immediately. Herein we must accept areas of poorer soils with even, perhaps, considerable past degradation of the natural vegetation and corresponding reduction in numbers of the remnant birds.

The situation in northern Latin America is essentially only an ecological repetition of the land-use picture by humidity provinces in the United States. Large areas of good forest cover still persist in the Wet and Rain Forest life zones in the Northeast, Appalachia, the Pacific Northwest, and in the higher portions of some of the western sierras. Likewise in the semiarid Southwest, there has been much disturbance, but extensive areas of natural vegetation persist. It is only in the intermediate and extensive humid and subhumid provinces where natural vegetation has been heavily reduced.

The preceding general discussion indicates that the present situation in northern Latin America is still not too serious with respect to the actual preservation of existing forms of biological life. Because of the geometrically rising population, however, we will very soon be confronted with a situation wherein the major part of our natural vegetation with its resident avifauna and other forms of life will be seriously threatened. There is no doubt that we are swinging beyond an optimum man-area relationship, so that if man does not learn to control his own population growth, then impartial ecological forces will bring about disastrous reductions in the human species.

The main question now, I believe, is how much of the natural environment, including species, will man destroy before he brings himself or is forcibly brought back to a more equitable balance with area. Although we cannot arrest the tremendous destruction in progress, we can possibly conserve enough judiciously selected samples of vegetation with its animal life to avoid any appreciable extinction of species and to serve as sources for expansion when human population pressure on the land swings downward or at least stops

expanding. My impression is that it is too late to worry now about population levels of wildlife. We will be fortunate if man can save adequate samples of the originally rich biological life.

The problem boils down to how many samples are needed, their location and areal extension, and how to establish and maintain such preserves during the coming 25 to 50 years, or even longer, before the prospect of a steady-state population becomes firm.

Although minimum numbers for species survival and the area needed for avifauna are higher than for plant species, a greater number of sites is more essential to include all the plant species than for birds. Considering trees alone, over a period of time one may count dozens of species of birds which visit one tree. On the La Selva tract, Dr. Slud recorded well over 300 species of the avifauna, whereas it is doubtful that the tree species reach 200. But in the 50,000 K² of Costa Rica, tree species comprise from two to three times the number of bird species. This implies that fewer preserves would be needed to include associations with all of the avifauna of the country than to be all-inclusive for tree species.

The number of life zones gives only a rough estimate and is below the minimum number of reserves needed, although it should be possible many times to include portions of two or more life zones within one preserve. In Central America, where a part of a life zone is monsoonal, tracts on both the Caribbean and Pacific sides of the divide are needed. In general, there is a wider range or number of associations in the lower elevation life zones than at higher elevations.

The areal extension of reserves is in part a technical question of desirable space, but it must also be politically defensible. Perhaps Mexico, Colombia, and Venezuela can justify extensive parks, but within the countries of Central America and Panama, we may have to lower our sights to units of rather small acreage, especially so in the more favorable climates. Large areas of natural reserves within small nations with high population pressure appear to be impractical.

Specific locations for reserves should be selected on the basis of highly technical considerations. They should comprise as great a diversity of natural associations as possible, be relatively accessible, and selected as those geographically and politically easiest to protect. Priority must be given to selecting and establishing areas in the intermediate humidity zones.

Use of these reserves must be restricted to observation and study. Zoological collections within them should be definitely prohibited, even for scientific study. Protection from poaching will be difficult enough per se without adding the onus of an apparent reservation for hunting by foreigners alone. Scientific collections should be carried on only in those areas rapidly being changed by agricultural invasion.

The most interesting problem at the moment is how to establish and maintain such reserves. Those who have lived in advanced nations with their high level of living are normally imbued with a false general sense of the effectiveness of legislation and government control in protecting natural reserves. In the small tropical and subtropical nations, beset with multitudes of subsistence agriculturists and rapid demographic growth, we are faced with a very different situation. Those governments are now literally overwhelmed with severe economic pressures, so that their major efforts must be exerted on finding the means to maintain even a minimum of the basic necessities of social organization, such as schools, water supplies, electricity, hospitals, and roads. They can pay no more than lip service to the concept of effective natural reserves.

When this is understood, one realizes that public opinion favorable to reserves and organized through committees cannot be effective either because, in the first place, such groups represent only a minority of the public, and secondly, they can do no more than appeal to the government, which itself cannot move effectively in that realm.

Clear thinking and new approaches are surely in order if we are to find a satisfactory solution in the small nations. We at the Tropical Science Center believe that a local nonprofit scientific organization might possibly be used as a device to procure and maintain a series of reserves during the approaching period of heavy population pressure. This would require international assistance and backing together with local government acquiescence and support.

However, timing is of extreme importance. For effective results, any program must be initiated right away. Immediate action is needed to save even small portions of the natural habitats in the intermediate climates. It is there also, where population pressure may already be high, that the techniques of maintenance, including primarily the securement of the respect and support of the surrounding inhabitants, must be worked out. They obviously would require facing up

to difficult problems immediately. If the easy route is taken, however, that of establishing parks located only in presently isolated areas, then we may not know how to save these when population pressure reaches their borders.

We must make our foreign aid more than just a fostering of temporary production and of keeping the growth of population at a high level. The myth of being able to step up food production as fast as population is growing in many of the already overdeveloped poor nations can only lead to further destruction of natural resources and more serious problems when we are finally forced to face up to the increasing ecological imbalance. Knowing that life for man must be broader than food securement alone, we must somehow assure the preservation of the birds, other animal life, and samples of natural vegetation through the coming period of great pressures on the land. Somehow all people must be induced, even if through indirect channels at present, to maintain a significant portion of their rich natural heritage for future generations to know at first hand and to enjoy. To do this we have to do more than continue to say some nice words for conservation or create parks on paper.

Discussion

VOGT. Would Dr. Holdridge hazard a guess on the extent to which these governments would welcome the preservation of such land and honor a commitment, provided funds are available to purchase the lands and administer them?

HOLDRIDGE. In speaking mainly of the governments of smaller nations, I think they would welcome it, but in actuality do not want to accept the responsibility.

VOGT. Or the cost.

HOLDRIDGE. Or the cost, right. We do borrow money for almost everything today, but there are strong political pressures from the subsistence agriculturalists. We cannot expect or ask the governments of small countries to take care of conservation adequately on their own. It is too optimistic to expect that by their establishing a law or a park, we are going to have a natural reserve. We have to face this right now—that it does not follow. This is an extremely tough economic situation to face and the preservation of something for the scientist for the future is one of the easiest things to put off until tomorrow.

FOSBERG. Les, how easy is it for a private owner to protect an area in Costa Rica in its natural condition?

Is this sufficiently within the pattern of what is accepted so that you do not get impossible pressures?

HOLDRIDGE. Up to the present time, this has been very effective. Within the more favorable climates, the only natural areas left are on big farms. But remember that the pressures are now building up against the "latifundios." High taxes are being placed on those natural areas to force their conversion into colonies of small agriculturalists. The landowners have held them about as long as they can.

LEHMANN. In my country many large landowners keep large lots of forest for their future heirs. But now the agrarian reform is being imposed on all of us in order to get money from international sources.

EISENMANN. This agrarian reform code is a matter for which the United States may have some responsibility. It was understood in some Latin American countries that obtaining financial benefits of the Alliance for Progress was more or less conditioned on adoption of certain agrarian reforms. The effect of these agrarian reform laws is materially to reduce the control a landowner has over his own property and subject him to expropriation if rural land is not actively employed in a manner considered socially useful. I have read only the Panamanian Agrarian Reform Code, and I must say that some of the language suggests translation from English law. It is not a translation of a U.S. law. Let me make clear that in the United States we nowhere have land laws which so strongly reduce the powers of landowners over private property. The Agrarian Code in clear terms does expressly acknowledge the value of forest preservation for purposes of watershed protection, prevention of soil erosion, wildlife maintenance, and tourism. However, some landowners interpret the law as not allowing the maintenance of land in forest unless the government has declared the area as dedicated to forest, or something of that sort. The most difficult problem relates to areas of what Dr. Holdridge calls "dry forest," which were cleared generations ago, but which now, in the landowner's opinion, were best allowed to revert to forest. As I read the law, it is risky for a landowner to use his own judgment, unless he has governmental approval. I wish to raise a question about the doubt expressed by Dr. Holdridge as to the value of the governments setting up parks and reserves. It may be that in some parts of Latin America it is harder to protect government property from infringement by squatters and timber cutting than private property.

Nevertheless, once the law creates the public reserve it gives some assurance that the land will not be permanently alienated for other purposes. And it is certainly easier and cheaper to do now than it will be when the population has increased.

BUCHINGER. I do not think that there is any point in discussing which is better. I believe each country should have both national parks and privately sponsored natural areas. The discussion we are having proves the need of saving natural areas. We also agree that there are some conflicts in governmental circles about the best way of land use and land saving. Public pressure is needed to guide and fortify the governments; even those which are willing to set up and maintain park systems need the public awareness, and they welcome pressure groups to maintain the continuity when a new government is elected. The establishment of national parks is most important; but as I was pointing out earlier, a network of natural areas owned and protected by nonprofit Nature Conservancy types of organizations is also very good. I do not think we should be discussing what is better. I believe the governmental and private efforts must complement each other.

HOLDRIDGE. I would like to add just one thing to your comment, even if it is a bit pessimistic. If national parks are set up in isolated areas they may be held. Why can they be held? Because no one is in those areas yet. Where there are many inhabitants the results are quite different. We had a government reserve set up along the highway in southwestern Costa Rica encompassing a stretch of beautiful forest. But when the loggers had finished the surrounding areas, what did they do? They went right to the top man of the nation with their stories of idle machinery and men out of work. The reserve was soon finished.

I would agree with you that we must keep trying through legal channels, but obviously we must develop a more effective system for holding reserves.

VOGT. I was particularly interested in Dr. Holdridge's suggestion that these things might be put under control of something like the Tropical Science Center. I remember, back in 1942, going into a national park in Mexico with government employees and having about eight men with .30-.30 caliber rifles stand behind trees and watch us come. They were bootlegging timber off the national park. And at that time this was a payoff to a "politico" who had been made

head of national parks. He was allowed to take out the timber.

Now that has been changed a great deal in Mexico. But in these other countries the government cannot stand the pressure. Mexico just lost 25 percent of one of its parks to occupation by squatters. The local politicians came to the minister of agriculture and said, "Look, how can we get rid of these people? Where can they go?" And literally there was no place, no local land. But I just wonder if such areas could not be set up as private property? I should like to modify that term because in Mexico, for example, foreigners are not allowed to own land within a certain distance of the border. There are other places where the private owner will be sold out for bonds or through agrarian reform, as Les says. But if something like the Tropical Science Center could be financed to buy these lands, they would be under the control of an educational institution. It would be impersonal, it would be nonprofit, and I think it could demonstrate the usefulness of what it is doing, not only in saving species, but as research areas, and so on. I wondered for a long while if this might not be the answer in some of these very poor countries, and whether it would not be possible to get together a consortium of foundations. I do not think we should ask any single foundation to do it, but there are a few in Latin America, including one or two in Venezuela. There are one or two in Argentina, and one that I know in Central America. Ford, Rockefeller, Nuffield, and Wenner-Gren might come in on this, and perhaps set up a \$100 million revolving fund over 10 years for the purchase and administration of this land. It can be bought very cheaply, at perhaps a dollar or two an acre—much of it because it is so remote. Then it could be put into the hands of an independent international organization. I wonder if something like this might not provide the mechanism for saving these habitats.

BUCHINGER. I just wanted to comment on this. I do not believe this to be the right solution. Something very similar was set up some 20 years ago and failed because it was an international organization. In Argentina it ended with Peron's government. Most governments resent foreign interference. Even where they are willing to cooperate, they prefer to set up national parks on both sides of the border and to maintain their independence. Such examples exist with Chile and Argentina. When making propaganda for the ideas the Nature Conservancy stands for, people

were most interested in the fact that, in spite of trying to help, the Latin American Desk does not want to have branches or chapters in other countries. We believe the only way to save an area is to leave it absolutely in the hands of a local, private, nonprofit organization. The moment international involvement is present the danger of losing the land again is great. Deunler de la Tour was setting up his Pro-Natura as an international agency and failed. Whenever land holdings and other assets are under foreign control there are many problems.

I think the best way to help in Costa Rica is for Dr. Holdridge to take over the organization of such a watchdog group. This should be a Costa Rican, private, nonprofit organization, and everybody could help them, but I would not put the matter into the hands of any international agency.

ALDRICH. I am impressed by the importance of having a reserve which is representative of the different natural ecological types throughout the world. And, therefore, I am impressed by the life-zone concept presented by Dr. Holdridge. If I interpret this correctly it shows the importance of having more parks, more areas at least, in the tropical portions of America than in the temperate portions. Therefore, I would assume that we should strive for many more areas in tropical America than in North America.

PETERSON. Does not the designation of an area as a national park sometimes work against it? I recall Dr. Lehmann, when I was with you in Colombia and we witnessed fires and cords of wood within a certain park, I asked about it and you said, "Well, some of the local people feel that now that it is a national park it is theirs to exploit and to burn." Is that attitude frequent? How do we get around that difficulty?

LEHMANN. That is because of the lack of education. In Sierra de la Macarena a natural reserve was started, as I mentioned before this morning, by a law of the Congress in 1948. Recently, through a government decree, it became a national park. We trained 25 people to control this area in the beginning; and just before it happened, certain parties placed some signs properly instructed to educate the people who were actually living in the area. Among the things we would say to the people is that they will never get a title to the property inside the park area. But if they move to just outside the park area they can get a title to land like that within the park. And people are moving out. Last year one of our people from the Ministerio de Agricul-

tura took the course in national park administration at the University of Michigan, and this man is now instructing these people in the region of the national park. As I told you this morning, I think our main problem is lack of education, and I always ask for help to educate our people through movies, through TV, or any other means by which we can reach the people. In our museum in Cali, thanks to the generosity of the Conservation Foundation, we have some nice films of conservation. One of my students, who is a nature warden in the state of Mague, brought to the museum 80 squatters from one of the areas near Paco Forall, Farellones. These are people who would say, "I will kill you," if a policeman or a park warden should tell them they will be put in jail for cutting a tree. To these people I showed the film by Dr. Vogt and also a film that I have made myself of our problems of erosion, river destruction, fish dying in the river, and other things. They understood the problem through these visual aids. I said, "you are destroying the food of your children tomorrow." I used many arguments and they just came out and said, "Why do not people who go there to the farms, to our properties, to our plots, talk to us like you are doing here? Where can we go and get seeds to plant trees to replant the forests?" This proves that we can educate the people.

RITTERBUSH. I would just like to ask Dr. Holdridge a question which will be very vague. What Mr. Phelps said about men with machetes making their way into the wild areas reminded me of a very provocative passage in one of your own articles in which you say that these people appear in the guise of pioneers but that they may unwittingly be destroying their own future. Without its biological endowment the cleared land may be valueless. There may be a yet unacknowledged obligation for tropical scientists to discover relationships within tropical plant and animal communities which could be translated more readily through applied science into economically significant technologies. Physics is so readily translated into electronics technology, for example. It seems to me that the kinds of studies you conduct are helping to establish ways to use modified environments in ways that might be profitable, without hoping for automatic transmission of temperate-region technologies. Will the tropics ever be able to prosper under economic rules which are generated in temperate areas? Might we not aim to foster natural-resources-based technologies which are in some sense indigenous? Then the pres-

ervation of wild areas and the research associated with these areas might be a basis for the development in many tropical countries of new kinds of technology which may even involve different economic patterns from temperate regions. I wonder if there might be any point in trying to interest industry and other sources of credit—international development agencies such as the World Bank. Such processes would require that wild areas be maintained as experimental and study preserves, upon whose continued existence the economic well-being of the developing countries would depend.

HOLDRIDGE. Although it has been written out previously, man does not know what potentialities exist within tropical areas or associations that have not yet been studied. Who could have dreamed of how important little *Drosophila* was to be to genetic research. There may be much in the unexplored gene pool of potential value to man. But, of course, these arguments are not effective on the small farmer who wants to grow enough corn or other food for his family this year and the next.

LEHMANN. This is a question posed by the Alliance for Progress. The president of my country now is having to split the state-owned lands.

HOLDRIDGE. We are borrowing or being given money to fell forests and make new pastures, even though most such areas are not going to be permanent pasture. We are talking here of establishing reserves, while other people in this nation are sending money to fell forests. Somehow or other we should get together and work out a program that is compatible and in the best interests of the tropical countries.

EISENMANN. We were talking about misuse of land for agricultural purposes, although obviously best fitted for maintaining forest. Has any extensive research been done on tree crops as food crops? I do not mean coffee, which is a kind of stimulant, not really food. Growing of tree crops might provide food in the tropics, and still preserve a good deal of land from erosion.

HOLDRIDGE. This is a good point. When we have a geneticist, he may wish to work only on corn because he studied corn genetics. In the case of the pejobaye palm, which the indigenous people used as a main supply of food in the wet, high-rainfall areas, there are no geneticists working on the plant.

BUCHINGER. In Misiones geneticists are working on the yerba maté and have collected sample materials from different stocks.

The Future of Avifauna in Guatemala and Its Relation to Tourism

Jorge A. Ibarra

Because of its diverse climate, which results from an interesting and complex topography, Guatemala contains a unique avifauna that has aroused the interest of ornithologists for many years. They have, in turn, influenced the "bird watchers" with their publications and attracted tourists to Guatemala.

Scientists have greatly increased biological knowledge through investigations carried out in Guatemala. *Biologia Centrali-Americana*, written by Osbert Salvin and published by him and Frederick Ducane Godman in England, is one publication that should be mentioned. Salvin first visited Guatemala about 1857. He was fascinated by the luxuriant vegetation which provided a safe refuge for a great number of species of avifauna.

Salvin made other trips to Guatemala accompanied by Godman and both found an abundance of birds in their travels. The splendid quetzal probably did not escape the keen sight of the investigators when they visited the cities of Quezaltenango, located in the western part of the country, and Coban, in the north. It is likely that Salvin admired the "trogónido" that nested near the cities. He probably experienced the same reaction to the ocellated turkey (*Agriocharis ocellata*), as its color and form give rise to admiration.

The naturalists watched interesting species of avifauna near the city of Salamá in northern Guatemala. It was in this province that Salvin discovered one of the most notable "vencejos" (black martin) of the continent, and which he named *Panyptila sancti-hieronimi* in homage to the municipio of San Jerónimo where these birds were found.

Ludlow Griscom, author of *The Distribution of Bird-life in Guatemala*, wrote in the 1932 Bulletin of the American Museum of Natural History that 90 percent of what we know about the ornithology of Guatemala is due to the explorations of Salvin and Godman

and numerous collectors whom they have trained. These works are still furnishing valuable information to naturalists.

Ornithologists wishing information about the places of origin of some species consult *Biologia Centrali-Americana* and are often disappointed because many of the species mentioned there are not found in abundance or have disappeared from the places mentioned. The quetzal (*Pharomachrus mocinno*), for example, found in the municipio of Chiantla, has hidden itself in the wild forests or has succumbed as a result of the advance of the population and the practices of those who ignore the wise use of natural resources.

Griscom tells why the Guatemalan national bird, the quetzal, is not as common as one would imagine: "Formerly a common bird in the cloud forest throughout the mountains of Guatemala. These forests have been greatly reduced in the last 50 years by clearing for coffee plantations, and the Quetzal retires as soon as primeval conditions are destroyed. It has also been unmercifully persecuted for its plumes, and untold thousands were exported for decades. It is now protected by law, and a genuine effort is made to prevent its exportation." In 1915 A. W. Anthony expressed the opinion that the quetzal, despite legal protection, was no longer common. There were a few localities where it was sometimes seen, but as a result of the constant persecution the number was notably reduced in places where formerly it had been seen regularly. Griscom writes that one can still see some examples in the Alta Verapaz, but in this place they were confined to wild forests and sought high trees in order to defend themselves from the weapons used by the natives. Further on he mentions that in the municipio of Nebaj, west of the department of Quiché, he was assured that the species was abundant, but he never saw a single one. Great must have been his surprise

when, in the municipio, the natives brought him several quetzals killed with blowguns. He was even more surprised to find that the Indians were wearing hats adorned with long supercaudate plumes. After traveling in the municipio and adjacent country in 1959 I never failed to marvel at the presence of this heraldic bird. One of the fundamental reasons for the scarcity of the quetzal, as I have mentioned, is that many forests where this species nests, have been cleared of trees for coffee plantations. Forest fires and native hunters are others.

It is not surprising that the naturalist who visited 20 years ago would today find some great changes in the vegetation of Central America. Referring to this vital theme on the occasion of a conference in Guatemala, William Vogt said: "Guatemala is undoubtedly one of the most beautiful countries in the world. One always renews the spirit upon returning here, but the natural beauties are disappearing. Forests that should be protected in national parks are being destroyed for growing corn. The flora and fauna which attract the scientists or amateurs are disappearing. How many tourists have had the privilege of seeing the quetzal? In reality, how many Guatemalans know this bird of extraordinary beauty?" Vogt recalls his trip to Guatemala 20 years ago with emphasis on the rich vegetation that has now disappeared along the road extending from the capital city to the picturesque municipio of Chichicastenango, and he reiterates that the misuse of natural resources is not confined to Guatemala but is also found in other Latin American countries.

Logically, fauna decreases as forest cover deteriorates. Inadequate laws that do not prohibit out-of-season capture—especially popular among waterfowl hunters—contribute to this decrease. Undoubtedly the so-called "game birds" have suffered most from persecutors who use .22 caliber rifles (which cause much damage to fauna in general as great numbers are wounded and left to die) up to shotguns of high caliber which kill innumerable quantities of species in our forests, jungles, and on lakes and rivers.

Directors of tourist centers are now specializing in bringing to Guatemala groups of people who look forward to hunting with binoculars. Russell Mason, director of the Florida Audubon Society, has contributed greatly to the growing number of tourists who are delighted with the varied and beautiful fauna that inhabits our mountains.

As previously mentioned, the large wild game birds are the most persecuted and for this reason will disappear first from the areas inhabited by men. In 1931, the ornithologist J. Van Tyne, author of *The Birds of Northern Petén*, seems to have found in the municipio of Uaxactun, an important archeological center in the north, the following species in abundance: ocellated turkey, or turkey of Peten (*Agriocharis ocellata*), cojolita (*Penelope purpurascens*), paujil (*Crax rubra*), chachalaca (*Ortalis vetula intermedia*), mancolola (*Tinamus major percautus*), and other birds of less importance. They are now extremely scarce.

The ornithologist Alulah M. Taibel, author of *Uccelli del Guatemala*, did not have to go far from Ciudad de Flores, the county seat of the department of Petén, to enrich his collection. A short distance from Ciudad de Flores, which is surrounded by water, he captured chicks of the ocellated turkey which he took to Italy together with several species of *Tinamus major* and *Crax globicera*. The progeny of these birds are presently exhibited in the experimental station of Aviculture Rovigo, as professor A. Ghigi recently affirmed.

Rodolphe Meyer de Schauensee, the ornithologist, visited my country in 1935 and remained most of the time in the western mountains. There he obtained one of the most notable birds of the continent, *Oreophasis derbianus*, known by the natives as pavo de cacho (horned turkey) and faisán de cuerno (horned pheasant). This took place in Chichoy, a village of the municipio of Tecpan, department of Chimaltenango. He wrote that the natives assured him that such birds were common. Nevertheless, he got no more specimens and was told that it was a difficult bird to hunt because of the "deforestation" and native hunters. At the present time this beautiful bird does not exist in Chichoy, but it still inhabits remote areas of the mountains where *Homo sapiens* has not yet reached with his destructive weapons.

We believe the most endangered species is the *Burhinus bistriatus*, which is indigenous to the arid and tropical areas. Although this species was found in the markets of the capital several years ago, it has not been seen recently any place in Guatemala, and the possibility exists that it is in danger in other countries where it once was fairly common.

Another bird which is of concern to ornithologists as it seems to be disappearing is the Atitlán grebe, or zambullidor (diver), indigenous to and found only at

Lake Atitlán (first cited as a new species by Wetmore in his "Notes on Birds of the Guatemalan Highlands"). Griscoⁿ wrote that one reason which compelled him to stay in Guatemala was to study the zambullidor (*Podilymbus gigas*). During the nine days he was at Lake Atitlán he observed 200 individuals. Had not an order been issued by the government in 1959 prohibiting the hunting of aquatic birds in Lake Atitlán, the 100 zambullidores that nest in the lake would not exist today.

At the time this order was issued, it was not known that many years ago the black bass, an alien fish of the genus *Micropterus*, had been introduced. These voracious specimens fed on the fish the zambullidor used as food. This was mentioned in June 1962 during a conference at the American Museum of Natural History of New York and at the congress on ornithology which took place at Cornell University, Ithaca, N.Y. At this time I expressed concern about the practice of introducing alien fish in the rivers and lakes of Central America. Subsequent observations have confirmed that the black bass has effectively interfered with the natural balance of Lake Atitlán, since it not only feeds on small fish but chases the young of *Podilymbus gigas*.

Fortunately the World Wildlife Fund has cooperated with us and at the present time is doing an excellent job helping to preserve this notable species which contributes so much to the beauty of Lake Atitlán.

Another valuable contribution was made by Frank B. Smithe, an ornithologist and author of "Birds of Tikal, Guatemala," written for tourists visiting the Tikal National Park. Smithe started collecting in 1956 and continued his studies in Tikal National Park in cooperation with Raymond A. Paynter and Jorge A. Ibarra. Tikal is acknowledged to be important not only for its archeological value but also for the fact that a considerable quantity of new botanical species were discovered there which C. L. Lundell used in his book "The Vegetation of Peten," as well as in other publications issued by the Field Museum of Natural History of Chicago. Smithe refers to Tikal in the first work as follows: "Tikal is the biggest and most antique ceremonial center or city of the Mayan civilization known." Its archeological development is due to the "Tikal Project" carried on by the Museum of the University of Pennsylvania. The government of Guatemala recognized the value of this famous Mayan site and declared it a national park. The park area is 572 square kilometers. Both the Guatemalan government and the University of Pennsylvania

have stimulated biological investigation, making it possible for Smithe to publish the list of birds of Tikal.

We think it is urgent to establish national parks and equivalent reserves to avoid the extinction of endangered species, especially with the quick and uncontrollable rise in population. There are governmental agreements which prohibit hunting the quetzal and the zambullidor, and it is clear that the laws help to protect species in general, but we believe that it is necessary to enlist the cooperation of the newspapers, magazines, and other information media to illustrate the necessity of protecting and conserving nature and its resources for the well being of future generations.

The establishment of museums of natural history in the countries which do not already have them is an effective way to illustrate to the thousands of visitors the themes of conservation. Two museums of natural history have been organized, and conservationists communicate with the public in the magazine *Historia Natural Y Pro-Natura*, edited by me, which started in 1964.

In these publications I refer continually to the practice of immoderate hunting. In his lack of understanding the hunter has selected owls, falcons, eagles, and so forth as his prey. Insectivorous birds are captured by natives ignorant of the consequences of their actions. The publications also contain articles concerned with those who make excessive use of insecticides. On these and similar themes I have written many articles for the newspapers of my country.

These publications may contribute to the cause of conservation and the establishment of national parks. On the other hand, if adequate measures are not taken we shall witness with regret the extinction of several species. In his outstanding work, "Extinct and Vanishing Birds of the World," James Greenway expresses this idea in an effective way: "As far as extinct birds are concerned, we can only express deep regret that measures had not been taken in time to save their existence, thus avoiding an appalling impoverishment of life on earth. But when it comes to threatened species, we face a different problem. Can they be saved, and how? The answer varies according to species and circumstances. In many cases it will be possible to save them through appropriate protective measures the success of which entirely depends upon the wisdom and the good will of men. It is only a matter of stopping destruction."

Discussion

FOSBERG. Dr. Ibarra's mention of Lake Atitlán brought an idea to my mind that perhaps is worth following up in this matter of the means of protecting areas. This certainly does not apply to all areas, but nothing you can do will apply to all areas. I think the appreciation of natural beauty, especially in spectacular forms such as we have at Lake Atitlán, is something that is perhaps more widespread in the public consciousness than appreciation of birds. At least some of the areas that we like to protect are ones that are of spectacular natural beauty. If we could combine these two things and emphasize the fact that agriculture and engineering works in these areas do destroy something that not only is of value to the people who live in the country but is of tremendous attraction to tourists, more effective protection might be afforded to some of these areas. Of course, the immediate response is that if we bring in tourists it will result in deterioration of the areas. This is right. But I have one place in mind that might be an illustration of the opposite of this. One of the most beautiful single scenic spots that I have seen in the whole world is a place in Mexico called El Salto del Río Naranja. I saw this in 1947 and it was practically an untouched place, a magnificent series of waterfalls. I was greatly distressed when I heard that a hotel was to be built there some years after that. This upset me no end, because it would spoil it. I mentioned this when the subject came up a couple of weeks ago in England to someone who had been there. I said, "What a great pity it is that a hotel was built for tourists." He said, "Well, you don't know what you are talking about. If it had only been the hotel which was built for tourists we would still have a beautiful place even though there were some tourists there. But now they are building a hydroelectric plant, and this is going to destroy the whole thing." Well, if the Mexican public had been sufficiently enlightened to appreciate what they had in the beautiful spot we are speaking of, they could have prevented the building of this hydroelectric plant, at least. They would have had a slight modification as the result of the tourists, but I am sure that the birds and almost everything else would have survived. But nothing can survive inundation.

BUCHINGER. Speaking of tourism, yesterday in the Pan American Union we were preparing a proposal for the next tourist conference, which is going to be in Madrid. This is on international tourism in general,

and at the meeting the General Secretary is going to propose that in the Latin American countries a survey should be made to find out which areas would be suitable for parks. In the same recommendation it will also be very strongly stressed that all the tourist facilities have to be maintained in the zone outside the park, in a sort of buffer zone, so as not to spoil the natural values. A director from each Latin American country is going to be present at the meeting in Madrid, so we are very hopeful that through this conference we can call the attention of the public to our problems. This is a way of educating those responsible for tourism. I would also emphasize a point which Dr. Phelps made, namely that it is good to have national parks even if they are only on paper! There are two reasons for this. One is especially valid now because it is essential to have the land declared a national park to save it from being divided by agrarian reform. I mean, if you have declared an area as valuable, it cannot be divided. Secondly, as in the case of Chile, where so often the land is mistreated, it helps when, as is now the case, a minister who is really concerned about conservation matters does not have to go to the president and ask Congress to establish a reserve. He can work according to preexisting laws. He can get rid of the squatters by paying them some indemnification for houses or whatever they have in their fields.

VOGT. May I express the pious hope that this international parks meetings will recommend to our own National Park Service that the development take place outside of the park areas?

BUCHINGER. Dr. Vogt, it is funny that you should mention it, because I have already been receiving protests from U.S. offices for what our Latin American countries are doing. For example, we are also proposing (and we got this recommendation approved) that along the Pan American highways they should try to reestablish natural areas, or at least where they are not yet destroyed they should save them. Somebody from the highway department here in the United States came to my office and told me that I should not be making such proposals, because being a Pan American congress its recommendations are also binding for the United States, and he pointed out how much money this would cost. I told him, "I am sorry the Latin American Committee on National Parks only represents the Latin American point of view."

Effects of Habitat Changes on Population Levels of the Avifauna in Honduras

Burt L. Monroe, Jr.

The republic of Honduras, with an area of slightly more than 43,000 square miles, is a close second to Nicaragua in size among Central American countries. As is the case in most areas of Latin America, human population is rapidly on the upswing, with a concomitant effect, often drastic, on natural habitats and communities operating therein. Although there have been changes with respect to virtually all types of habitats in recent years, certain ones are more critically affected than others. Certainly the disappearance of the broad-leaved evergreen forests in the tropics must be rated as the most noticeable change, and the one about which something must be done in the immediate future.

In this paper I shall refer to broad-leaved evergreen forests in Honduras as "rain forests" if they occur below 1,250 meters (about 4,000 feet) and "cloud forests" if they range above this level. Thus rain forest is generally comparable to the forested regions of the humid lower tropical zone or to the Tropical Moist Forest Life-Zone (Formation) of Holdridge. Cloud forest may be roughly equated to the subtropical or humid upper tropical zone or to the Lower Montane Moist and Wet Forest life zones (formations).

Although there have been no quantitative studies of bird populations conducted in Honduras, a look at changes in the forest habitats and a comparison of observations and collections made since 1850 will give an indication as to the effect the forest reduction has had on the avifauna.

In the winter of 1857-58, George Cavendish Taylor traveled across Honduras along the route of the proposed interoceanic railway. From his accounts we have some of the earliest data concerning avifaunal records from the Republic. On January 7 he left Taulabe for Lake Yojoa, arriving there about dawn on the 8th; this distance of less than 10 miles required a day and

night's journey. His accounts of the birds include observations of many rain forest species, including *Electron carinatum*, a relatively rare forest motmot. The area from Taulabe to the lake was, in Taylor's time, a very dense rain forest. Today there are only scattered trees along the Río Jaitique, vast regions of rain forest having been turned into areas of long grass and scrubby second growth. From 1962 to 1964 I personally witnessed the destruction of two of the finest remaining small forested areas on the eastern side of the lake. There is still a large, untouched rain forest on the western side of Lake Yojoa, presently privately owned, but the pressure of governmental land reform will probably result in this region being opened up to clearing and settlement in the near future.

While on the subject of the region around Lake Yojoa, I should like to mention Cerro Santa Barbara, the second largest mountain in Honduras, with a maximum elevation of 2,835 meters (about 9,300 feet). Although there are no endemic forms of birds found on the mountain, a number of plants are known only from its slopes, and the remaining cloud forest supports a sizable population of several species of birds that are rapidly becoming rare, such as *Pharomachrus mocinno*, the quetzal. At the present time, the mountain forest is severely dissected up to an elevation of about 6,600 feet and more is disappearing every year. The mountain is literally "on fire" each year during the driest months (March and April).

In the lower Sula Valley around the large town of San Pedro Sula the forest has been reduced to one drainage area along the mountain base to the west of the town; this is maintained in an untouched state in order to preserve the watershed for San Pedro's water supply. Collecting the records of Joseph Leyland in 1855-56, George M. Whitely in 1869-70, and Erich Wittkugel from 1889 to 1893 indicates a wide area of

rain forest in the valley during the last century. Even as late as the 1930s, there must have been relatively vast forest on the north and south sides of the town, judging from the birds obtained by C. F. Underwood during this period.

Much of the lower Sula Valley has been planted in bananas at one time or another. During the 1950s, these banana lands were flooded annually as a means of controlling Panama disease; the flood-fallow lakes thus created formed a haven for migratory waterfowl and shorebirds, as evidenced by data recorded by Mark Trafton, former assistant director of research at the La Lima office of the United Fruit Co. However, severe flooding of the Río Ulúa in the late 1950s destroyed most of the dike system and the artificial flooding was discontinued. More will be said later concerning this matter.

Along the north coast from Tela west to Trujillo, most of the forest on the level coastal plain has been destroyed or reduced to small, isolated patches. Forests are maintained by the fruit companies, however, at San Alejo, Tela, and La Ceiba as watersheds for the areas in question. A special effort should be made to insure preservation of as much forest as possible in this region since there are a few endemic bird forms there (e.g., *Odontophorus erythrops verecundus* and *Piculus simplex allophyus*).

The largest remaining area of rain forest, the Olancho, is found in southeastern Honduras. Mostly uninhabited, the forest is relatively undisturbed except along its periphery. Man has begun to make inroads into the Olancho from the western side. In a flight over the region in 1964, I noticed clearing under way several miles farther to the east than in the previous year. Although the region does not contain any endemic forms, it is one of the largest, virtually untouched expanses of rain forest anywhere in northern Central America. At least 46 species of birds have their northern range limits in this region, either in Honduras or just across the border in Nicaragua.

Cloud forest is presently distributed in Honduras in the form of scattered, isolated patches. This distribution appears to be due primarily to natural, climatic change since Pleistocene times rather than to man's direct interference. Man has severely reduced these remaining patches. As mentioned previously, areas such as Cerro Santa Barbara have been partially or wholly cleared, even at the higher elevations in some cases. The avifauna characteristic of this habitat

(77 species in Honduras) is in decided peril in many places. Honduras today has perhaps the largest population of quetzals north of Costa Rica; but with the decrease in the forest, the quetzal is sure to go unless cloud-forest regions are set aside in the near future.

There are quite a few endemic species or subspecies of birds in the cloud-forest areas of the Honduran region (including small areas in northern El Salvador and northern Nicaragua). These include three races of *Dactylortyx thoracicus* (singing quail), each of which is known from a single restricted patch of forest; four hummingbirds (*Abeillia abeillei aurea*, *Lampornis amethystinus nobilis*, *L. sybillae*, and *Lampornis rhami saturator*); two jays (*Cyanolyca cucullata hondurensis* and *Aphelocoma unicolor griscomi*); and three other passerines (*Troglodytes rufociliatus rehni*, *Basileuterus belli subobscurior*, and *Atlapetes brunneinucha alleni*). The fate of these races is tied to the future of cloud forest.

Pine and pine-oak associations in Honduras are generally found in highland regions not occupied by cloud forest. Highland pine is widely distributed and the avifauna in it appears to be in no danger. I have no indication that population levels have been affected at all by man's interference. Pine habitat replaces itself in a relatively short time. The biggest problem is that certain logging interests obtain rights to a large tract and completely level the whole thing, with no replanting program or effort of some sort to maintain at least part of the habitat intact. While a few companies are conscientious and do practice good cutting procedures, most of those in the tropics (at least in Honduras) do not. But, for the moment anyway, there seems to be no major problem with this habitat.

The lowland pine savanna of the Mosquitia is a somewhat different matter. This habitat, restricted to roughly equal areas in eastern Honduras and northern Nicaragua, is apparently fire disclimax and is maintained (at least on the Nicaraguan side) by artificial burning. The habitat is present in a region that should be expected to have rain forest (i.e., tropical moist forest on the basis of temperature and rainfall) and is apparently being gradually replaced by rain forest in areas where burning is not practiced. The fires not only aid in maintaining a pine savanna through prevention of encroachment by rain-forest flora along the periphery but also preserve a continuing short-grass habitat for the savanna element of the avifauna. No less than seven races of birds are endemic

to the pine savanna of the Mosquitia: *Falco sparverius nicaraguensis*, *Amazilia cyanocephala chlorostephana*, *Pyrocephalus rubinus pinicola*, *Sialia sialis caribaea*, *Piranga flava savannarum*, *Aimophila petenica spadiconigrescens*, and *Colinus nigrogularis segoviensis*. All except the last were described recently by Howell from the Nicaraguan Mosquitia. These are mentioned here because, in this case, if man's influence by burning this region is removed, it is possible that the pine savanna could eventually be obliterated by encroaching rain forest. Also some control will eventually be necessary if excessive logging of the pine ever becomes a problem. At present there is no logging on the Honduran side.

A brief mention of the Bay Islands at this point might be in order. These islands, a small group of three main and a number of small islands, are located just off the north coast. There are seven endemic races of birds in the islands. Only one, *Ortalis vetula deschauenseei*, confined to Tuila, appears to be in any danger. The present population I estimate to be about 50–75 individuals. Being a game bird also has placed some added pressure on this species. Since all of the islands are relatively small (only one is larger than 9 miles in diameter), bird populations are correspondingly small. Forested regions in the islands are of a scrubby type and, at present, man has not disturbed the vegetation to the point of disrupting normal avifaunal population levels. Because of the inherent size of the populations involved, however, and the special case of *Ortalis*, these areas should be considered for possible conservation measures.

Looking at the situation from the standpoint of migratory species from North America, I can see no problem from the habitat end. Although I have not studied the situation in detail, my general impression is that the vast majority of migratory passerines utilize secondary forest or more open situations, a habitat avoided by many of the resident rain-forest species. With the clearing of forest that is presently going on, the total area of second growth is on the increase. Thus, if anything, man is probably creating some additional habitat for the migratory forms. In the case of the flood-fallow lakes mentioned earlier, man certainly is creating suitable habitat not otherwise available to migrating waterfowl and shorebirds. There has been some recent speculation that perhaps population limits of both migratory and resident passerines might be affected or even controlled by competition

arising on the wintering grounds, at which time huge numbers of migratory individuals occur in the same area with the resident forms. Once again, although I have not looked into this matter in detail, my impression in Honduras is that there is a minimum of competition due to the utilization of secondary forest by the majority of migratory forms. Regardless of the true situation in this respect, I feel that man's effect on habitat in Honduras has not hurt the outlook of migratory passerines.

Turning now to a more direct effect of man on the avifauna, I would like to mention the results of hunting pressures in Honduras. At the present time, hunting of game is more or less restricted to the wealthy class and to "northeamericans" present there for various reasons. Guns are very expensive, as is ammunition, and only a very small portion of the people possesses them. They are not attuned, so to speak, to the eating of wild game—as is the case in much of Africa where the populace goes to extreme lengths to devise ways and means of obtaining game, even to the construction of small snares to trap weaver finches and other passerines. With the exception of the use of slingshots by a few individuals, I saw very little sign of this in Honduras.

Honduras is a little far south for the main wintering populations of most northern species of waterfowl; 95 percent of migratory ducks are blue-winged teal (*Anas discors*) and lesser scaup (*Aythya affinis*). Hunting pressure on waterfowl is certainly not great and probably not even significant, despite the lack of game laws. There probably has been some effect on the resident ducks (*Dendrocygna autumnalis*, *D. bicolor*, and *Cairina moschata*), especially the latter, which seems to have declined in recent years. I am not sure whether this is due to habitat change or actual hunting pressures, but it is probably a result of both.

There has been a marked decrease in recent years of the larger galliform species (*Crax rubra*, *Penelope purpurascens*, and *Ortalis vetula*) that is apparently due primarily to hunting. *Colinus cristatus* is also frequently hunted, but there has been no noticeable effect on this common species.

Pigeons and doves are also shot, especially the palevented pigeon (*Columba cayennensis*) and the white-winged dove (*Zenaida asiatica*), the latter being present in great numbers in winter. However, I do not think there has been any significant decrease in either species in recent years.

Thus the overall effect of hunting seems to have caused little change in present populations of game birds, with the possible exceptions of *Cairina moschata* and the larger galliform birds.

At present pesticides are not widely used in Honduras. Only in the restricted south coast region, where cotton is grown, is aerial spraying in operation. The problem here is much more acute in the neighboring countries of El Salvador and Nicaragua.

The long-range avifaunal outlook, barring some definite conservation action in the very near future, is rather dismal in some quarters. Forest destruction is, of course, the biggest and most pressing problem.

In the way of specific action that might be taken right now, there are a few situations that require action before it is too late. In one case, that of the Lake Yojoa-Cerro Santa Barbara region, there is one strong economic reason for immediate action. It is always nice to be able to hit a government in the economic pocketbook, so to speak, when trying to find a reason for some necessary conservation action, rather than just saying it is necessary to save some of the wildlife. In 1964, a massive hydroelectric project, supported almost entirely by U.S. funds, was completed at the north end of Lake Yojoa. This power plant now supplies most of Honduras, including the two largest cities, Tegucigalpa and San Pedro Sula. The lake now drains artificially by the plant at the north end into the Río Blanco as well as naturally by the Río Jaitique at the south end. In order to maintain a satisfactory free drainage through the power plant, an extensive watershed must be retained. Already heavy silting at the north end of the lake may be seen. This situation could be used as an economic wedge for urging immediate cessation of destruction of the remaining rain and cloud forests in this drainage system.

At the present time watersheds of rain forest are maintained for several large towns, as mentioned earlier. Whenever the water supply is involved, this might also be used as an economic reason for maintaining the forest intact.

It will eventually be necessary to set aside forest regions (as national forests, perhaps) and keep them free of human interference, if these areas and their faunas are to be preserved. Just how this can be managed in areas where population growth is expanding so rapidly is a touchy problem, to say the least. This step in conservation is probably still well in the future.

Other possible measures include some sort of control of logging enterprises, where needed, and the eventual establishment of game laws. A return to flood-fallow procedures in the Sula Valley would be an aid to migratory waterfowl and shorebirds.

Let me emphasize again, however, that the major problem of the immediate future lies in the area of habitat preservation. All efforts for conservation on Honduras in the next few years should be channeled in this direction.

Discussion

BOND. I was interested in the preservation of pine hawks, which have been destroyed at a great rate. They still live in the central mountains and there are no pines within miles of the type locality at the present moment. Pines are being cut at a great rate on La Bandera, which was formerly known as Lomatina. In Haiti there is the same problem on the Morne La Selle where the La Selle thrush lives—the thrush Dr. Wetmore discovered. The pines have been destroyed and this may cause extermination of this very interesting thrush.

MONROE. At the present time there does not seem to be any problem on the Honduran side of the Río Coco; and I would like to pass this on to Dr. Howell, because I do know that in the past there has been logging in Nicaraguan Mosquitia. I do not know what the current status of this is. Perhaps he can tell you what they are doing on the Nicaraguan side.

HOWELL. I will show a few slides of this and discuss it in a little more detail tomorrow, but there has been logging for many years both in the highland pine areas and in the lowland pine savanna. In the highland region it looks as you might expect. There is strong evidence of overcutting but there is still a great deal of pine left. The country is sparsely inhabited in many of the areas where there is such pine, and I would say that the situation is somewhat similar to that in Honduras—that there is no immediate danger that the pines will disappear. In the lowland pine savanna most of the big pines have been cut and this was done many years ago. At present it is widely forested with these rather slender trees that are probably 50 to 65 feet high, and our estimate from looking at the rings on cut stumps is that most of these are probably about 70 years old. This savanna is fairly extensive, occupying about the same area as it does in Honduras. There

is a passive reforestation program being conducted by the Nicaraguan government at the present time and there is difficulty in enforcing the provisions of the law against burning of the savanna during the dry season, because this is used to remove the coarse dry grass to stimulate new green growth that is used by cattle. They are rather scarce anyway, and also rather scrawny in this area, so that the problem does exist, but fortunately at the present time I don't think there is any immediate danger to the species involved. In fact, as you pointed out, some of these may require at least a certain amount of burning to be maintained at all.

IBARRA. Certainly I have said that you are very well acquainted with these Honduran birds, and I am also very pleased to hear that you saw some numbers of the quetzal, the Guatemalan national bird. You also said there is not much hunting in Honduras, although people of Central America are accustomed to use slingshots and occasionally .22 rifles. Do you know of a project, law, or action to provide these birds protection within the borders of Honduras, especially the quetzal, which is so precious to Guatemala? I ground this question on your previous statement about the existence of some endemic species in Honduras.

MONROE. Well, there is one. The only species that is completely endemic is a hummingbird. Nobody knows anything about it except that apparently it is widespread. I do not think it is in any danger from a hunting standpoint. Now, the quetzal very definitely might be in danger, particularly if hunting by firearms becomes more common in the future, and I suppose progress is pointing toward that end. I imagine in the next few years it will be much easier to get firearms, particularly if the economic level is raised in the country. Then hunting certainly will be a problem. When I was there I did not notice any sign of anyone killing quetzals for any reason in the Cerro Santa Barbara region. Perhaps this has gone on in the past; I do not know. Certainly I would like to see the birds protected. Definitely, particular birds, including the quetzal, should be placed on a protected list. But what good this would do without proper law enforcement I really do not know.

IBARRA. I think that perhaps it should be recommended in the near future. Laws forbidding the capture and the killing of the quetzal are very necessary, not only because it is the Guatemalan national bird, but also because it is one of the most outstanding birds of the Aztecs and the Mayas. Such laws should exist

in Mexico and Central America where the quetzals live.

MONROE. I would like to mention that my whole point about the quetzal was that if we do not preserve the forest now, we will not need game laws or any protection for it in the near future. We must ask for the critical things first; that is, to get extensive habitat areas (or as much as possible) preserved in some places, and then we will need game laws protecting what there is.

WINGATE. Dr. Howell, I am particularly interested in your comments on the wintering passerines, because it is my own impression, gleaned from observations on Bermuda, that North American passerines that winter in the tropics, rather than being affected in a detrimental way by habitat changes there, may actually be increasing. Bermuda provides a unique opportunity for measuring changes in species abundance over a long period because there are remarkably comprehensive accounts of migratory species and their abundance going back more than a hundred years, the earliest compiled by officers of the British garrison at the height of the British colonial empire. One of the most notable changes over this period concerns the wood warbler family. A hundred years ago only half a dozen species were recorded from the island, and all but one or two were rare. Yet I now annually record over 25 species and many like the redstart can be described as common or abundant at the height of migration. We might argue that small birds were largely overlooked by the earlier naturalists, but the fact remains that they recorded many obscure passerines which are hard to find on Bermuda even today. How then can we account for the complete absence of redstart records, unless this species was actually less abundant at that time? The only other possible explanations are: 1. Weather patterns causing the occurrence of these small passerines on Bermuda have changed drastically, and I think this highly unlikely. 2. The migrant passerines were more thinly dispersed and harder to find owing to a greater extent of suitable habitat for them. In fact, old photographs and other records indicate that Bermuda had just about the same extent of forest cover as at present. I can only conclude, therefore, that some passerine species with wintering ranges in Central and South America have actually increased in abundance. This certainly seems to be the case for most of the wood warblers and perhaps a few other species like the indigo bunting.

MONROE. You may be right on this, I do not know; but I did not mean to imply in my statement that the increase in the secondary forest is causing an increase in the populations in North American birds. I am just saying that the wintering ground habitat is apparently not a major limiting factor, at least in my estimation, as compared to breeding areas.

HOWELL. This is true for many species. In some cases, such as that of the Kirkland's warbler, I do not think there is any doubt. But I think the increase in man's effect on the habitat has not in the slightest hurt any of the migratory passerine birds in Central America.

BOND. May I ask a question? You mentioned that in Honduras they usually have a built-in forest watershed above the towns. Is that preserved well?

MONROE. Yes, it is, as for example the case of San Pedro Sula. They have the watershed well guarded. They pay a local guard, and he is armed and permits no cutting and no habitation by squatters. They are very adamant about that, which is fortunate because the only forested area around San Pedro is up there on that one slope of that mountain range where they maintain the watershed. The United Fruit Co. maintains a watershed for all their stations. It seems to be standard also for towns along the north coast.

VOGT. I was quite impressed, as apparently Mr. Eisenmann was, by this preservation of watersheds, because it is fairly rare throughout Latin America. I should like to inject another bit of optimism—just a very little bit, maybe one-tenth of a milligram—into this situation, in that Honduras has organized the first national birth control program. They are beginning to establish clinics about the country. They are having a Pan American birth control meeting there within the next few weeks. They really are, it seems, tackling the population problem, and they may possibly be able to do something about it.

The question of land reform has come up a good deal, and that is a knotty one because of the amount of downright hunger, malnutrition, and scarcity of land for the small farmers. I wonder if it would be possible to get the Alliance for Progress to foster a land reform program, based on *land-use capabilities*, instead of on economics and politics? At the present time the politicians hand out land to the peasants to get them off their necks, and the chances are it has a 100-percent slope that won't last very many years.

Could we recommend through this congress a definite reconsideration of land reform policies and a limitation of agriculture to the areas that will sustain it?

WETMORE. May I say a word regarding this. Bill's suggestion of a land reform program is an excellent one. At the present moment I believe a plan is under development, at least in Panama, that will bring this to pass to some extent. Possibly the statements I am about to make may anticipate something that my good friend Eugene Eisenmann plans to say tomorrow. About 3 weeks ago I had occasion to call on the head of the Agrarian Reform in Panama City, where I was interested to find the very definite action program that is in process of development there. The plan is to take the squatters off the private lands. These individuals for years have preempted land for a little farm on some hacienda, have lived there for a while, and then have moved to another location. In Panama landowners are now aware of developing pressure for land and are trying to clean up their boundaries. The more foresighted are paying squatters to move and are assisting them to settle somewhere else, usually near the main highways. The government also, under the Agrarian Reform, is buying up tracts of land presumably suitable for agriculture and is arranging to give these former squatters title to small parcels that they may own and farm. I am not certain of details of the arrangement but believe that it is on some long-time basis. Some months ago a great deal of publicity was given to a program of this sort at the time of the national agricultural fair in David in Chiriquí. In this, as part of the public ceremonies, 77 landowners were presented with titles to the bits of land on which they had been settled. There have been other programs of the same kind. In the office of Agrarian Reform they showed me, with great pride, a plaque indicating aerial mapping of the lowland area along the Pacific side from Chiriquí across to eastern Panama. With this survey they are planning on a program of land acquisition in various places through the whole area in an attempt to clean up this system of squatters. What this will mean is destruction of a good many forest areas. The ordinary practice of clearing is the usual slash and burn where the undergrowth is cleared, all the trees cut down and burned, and then the area is planted to rice, corn, and what have you. This is now a definite program in Panama, and I gather in other tropical countries as well.

VOGT. Is this done on the basis of land-use capabilities? In many places they just take a hunk of land and turn people loose, and they ruin it.

WETMORE. It is supposed to be on land that is suitable. Whether the soil is always good or not I do not know. At any rate there is an attempt to take some of these people off the steep hillsides which are utterly useless after 2 or 3 years of cultivation, and put them

somewhere else. On a recent journey I was down in the Burica peninsula, where in one area the Chiriquí Land Co., a subsidiary of United Fruit, has its main holdings inland. There is, however, an area toward the coast that is also owned by the Chiriquí Land Co., but which they were not using, in which squatters were coming by the dozens to make their little farms and sow their crops.

Avifauna in British Honduras

Stephen M. Russell

British Honduras differs in a number of ways from other regions that are being discussed at this conference. It is very small—the total land area is only 8,600 square miles. It is relatively low—the highest elevations are only 3,700 feet. The avifauna of the country is known from 460 or so species of birds, so it does not compare with the other central and northern Latin American areas in the number of species.

It is worthy of consideration because it is on the route of many North American migrants. Numerous birds remain there throughout the winter. It shares with Mexico the second longest barrier reef in the world. The barrier reef extends north and south off the east coast and is shared with Quintana Roo and Yucatan. Finally, British Honduras retains many original habitats in a somewhat undisturbed state. This is only because the population is about 100,000 individuals. Half of these people live in the principal town, Belize. So in many respects it is still in the same state that other Latin American countries were in quite a number of years ago.

The geographic position of British Honduras is oriented north and south. It is 150 miles from north to south and 50 to 60 miles from east to west. Guatemala borders it on the west and south and Mexico on the north. A series of islands along the Caribbean coast constitutes the large barrier reef.

The main habitats or vegetational types in British Honduras are not really different from those in other parts of Latin America and include tall humid forest which we generally call rain forest. In some places in British Honduras these are undisturbed forests and have not been logged at all. There are the usual second-growth types of vegetation ranging from that which follows the slash-and-burn type of agriculture practiced in the colony up to those at the point where you draw the line between second growth and true tall forest. There are pinelands of the same sort that occur in Honduras and Nicaragua. These are lowland pine areas. There are extensive savannas. There are keys,

some of them planted in coconut palms and others supporting mangrove swamps. Then there are the minor vegetational types.

The annual rainfall varies from about 50 to 200 inches, but the area with 200 inches of rainfall is very limited in size. The southern part of the colony is wet and the northern part is dry (about 50 inches, as opposed to 150 inches).

The history of British Honduras with respect to its vegetation is somewhat different from many other areas under consideration at this conference. The Mayan empire included probably all of what is now British Honduras, so at one time or another the entire country was under cultivation. The Mayan type of agriculture was relatively advanced. They built terraces and they presumably cultivated the land successfully despite years of use. After the decline of the Mayan empire the country reverted to the tall rain-forest type of vegetation, and for all practical purposes the rain forest that occurs there now would be considered "virgin" forest. It is old enough so that it has certainly reached climax form.

Today the situation is again such that the increase in known population is depleting the forests. Most farmers of the country practice slash-and-burn or milpa type of agriculture. The land that is cultivated is not very good to begin with. Therefore, it is possible to raise only one or two crops on an area before it is abandoned and second growth takes over. It is probable that, as the country develops, the use of fertilizers and mechanized equipment would allow British Honduras to produce more food per unit of area; but, of course, this is a long way off.

Land use in British Honduras began with the exportation of logwood, which grew profusely along the lowland streams. Then logging of mahogany followed, but at first only very large trees were cut so that perhaps only one tree per acre would be extracted. A bulldozer pulled out the felled tree. There would be one small trail to the tree and the forest, and the plants

and the animals in the forest were not really disturbed by this type of logging. Within a year or two even the tractor trails were obliterated. During the past ten years the situation has changed somewhat. Instead of only mahogany, other trees are being taken. Instead of only large mahogany, small mahogany are cut as well. After a forest area has been logged today, it shows. There is a definite effect on the birds.

It might be worth pointing out that many species of birds are characteristic of the tall humid forest (or rain forest) and also occur in tall second growth. Second growth will replace the plantation type agricultural farms within a few years. About 40 species of birds occur almost exclusively in the so-called rain forest, and these 40 species will be the ones most drastically affected by the clearing of the land on a large scale. Several times that number would do quite well in second-growth situations. Since we had a discussion earlier about the succession that follows a slash-and-burn type of agriculture, it is worth noting that in British Honduras new vegetation follows the planting of corn in such a plantation almost immediately.

Pineland areas perhaps owe their existence to periodic burning and constitute about 14 to 15 percent of the total land area. They are all lowland pine areas. Pines are harvested for lumber. The pineland areas are not devastated by the logging operation, however; the pine logging industry is highly selective. The forest department regulates the logging procedure quite closely and I would say, in general, the value of the pine logging industry is appreciated. The forestry department does attempt to restock areas that need it. In British Honduras the pineland avifauna is unlikely to change in future years because of any change in habitat.

One additional point about pinelands: The forest department has been extremely effective in preventing fires in pinelands, to the extent that in some areas the pinelands are being crowded out by the adjacent rain forests. Monroe mentioned that perhaps natural causes may be important in maintaining pinelands. I have had personal experience with some of these natural causes. In 1963 I established a study area in a lowland pine region in southern British Honduras. I surveyed my study area and marked off grid lines and proceeded to do census work for 2 days, I thought I had picked an excellent location. It was adjacent to the district forest department headquarters. There was a fire lookout tower on the study plot. To make a long story

short, I left that study area and went south a few miles; 2 days later the message reached me that a bolt of lightning had hit a pine tree in the middle of the study area and had burned something like 32 of its 37 acres in spite of the adjacent fire-fighting equipment and fire lookout tower. So lightning is definitely involved in the control of pinelands.

We have not had much discussion of birds that nest on off-shore islands. Birds nesting on the keys have undergone the most serious depletions in numbers and species of any of the birds in British Honduras. Salvin visited these keys in 1862 and his record of the birds that were present and nesting is the only one we have that dates back very far. Of the species reported by Salvin in 1862, nine are no longer breeding birds in British Honduras. The species are the double-crested cormorant (*Phalacrocorax auritus*), snowy egret (*Egretta thula*), Wilson's plover (*Charadrius wilsonia*), Roseate tern (*Sterna dougallii*), bridled tern (*Sterna anaethetus*), least tern (*Sterna albifrons*), sandwich tern (*Thalasseus sandvicensis*), and the black noddy (*Anous tenuirostris*). I think it is quite probable that humans have had a lot to do with the disappearance of these birds in British Honduras, as in other places. Eggers have taken their toll of nesting sea birds, and have taken not only eggs but also adults. For a number of years, the red-footed booby (*Sula sula*) was in considerable danger in the colony. Some time ago the government established a refuge which included Half Moon Key, which is the only area in the western part of the Caribbean where the red-footed booby nests. As a result of the protection extended the bird, the red-footed booby is today in good shape. I think probably part of the success of this refuge has been the fact that there has been a lighthouse on the island, therefore there has been someone there all the time. Also, almost everyone in the colony knows about the booby and seems very pleased that he has a bird that other areas do not. In other words, there seems to be a considerable amount of personal interest and pride in the bird that they have protected. I know of no adverse human effects on the booby now. There is certainly no eggng or taking of adult birds. Many of the keys today have been planted with coconut palms. People live on the keys, fish, and harvest coconuts—settlements are springing up on quite a number of the islands.

British Honduras is occasionally in the path of hurricanes, but, although it is struck by hurricanes every

few years, extreme damage is rare. On October 31, 1961, Hurricane Hattie swept the coast of British Honduras with winds of 200 miles an hour and coastal tides of 15 feet. The tides actually flowed inland for several miles in the lowlands. It appears that tall forest suffered most. I was there in 1963, a year and a half after the storm, and my impression was that the large forest trees were not flexible (i.e., not limber enough) and therefore large limbs broke off, or the entire tree snapped like a match stick. The destruction to the forests (the type of habitat that is disappearing now) was extremely great. The second-growth vegetation was more flexible and, although the leaves and twigs may have been blown off, I think that the overall damage was not so considerable.

I have some data indicating the effects of the storm. Walter Nickell banded birds in British Honduras in the spring of the 2 years preceding the storm, and then also in the spring following the storm. He noticed in 1962 a reduction in every species that he had banded in the 2 preceding years except one, and that was a little seed finch, *Sporophila torqueola*, which increased, as you might expect, with the increase in open vegetation. He also noted certain reductions in the numbers of North American migrants. He has good evidence indicating that the orchard oriole (*Icterus spurius*) was down 90 percent in 1963 over 1961 and 1962. I think his data are useful because he did have his nets suspended in exactly the same areas each year. The data might be misleading, however, because perhaps the birds were not killed but were just dispersed by the winds. Perhaps the ones that survived moved out of the devastated area after the storm. In any event, in that one area, there was a considerable reduction of this particular North American bird. The foresters in British Honduras estimate that it will require at least 50 and perhaps 100 years for the forest to really overcome the damage that was done by Hurricane Hattie. The tall rain forest areas today are almost impenetrable masses of vegetation. There are many large trees and limbs down on the ground and, with an open canopy, second growth has taken over and it is almost impossible to get through it. I spent 4 hours penetrating 200 yards of this type of destruction.

I have a little information that suggests that the composition of the rain forest avifauna was also altered. I made censuses in 1957 in rain forest areas and then again in 1963 after the storm. Of the 40 species that I mentioned which are more or less restricted to tall

rain forests, my censuses involved 20 species. Of these 20 species of the tall forests, two increased in number, eight stayed about the same, and 10 declined more or less drastically. Birds of open areas increased rather spectacularly in this same region. At this stage, there is nothing that man can really do about hurricanes or the effects of hurricanes on wooded areas of this sort; but I think in British Honduras, at least, hurricanes are a major factor in determining the structure of the vegetation.

With regard to the effects of hunting in British Honduras, it has been the custom, probably for generations, to obtain as much fresh meat as possible from the forest. In fact, logging camps employ men to go out into the bush and obtain deer and larger birds. There are three large game birds which are frequently taken. These three are the ocellated turkey (*Agriocharis ocellata*), the great curassow (*Crax rubra*), and the crested guan (*Penelope purpurascens*). Although these birds have been extensively hunted for a great number of years, I do not believe that they have been reduced in numbers appreciably. The smaller game birds, such as tinamous and chachalacas, were and still are somewhat infrequently taken because, as in other areas in Latin America, the cost of the shotgun shell must be weighed against the quantity of meat that the hunter would obtain from the potential game bird. So anything smaller than *Tinamus major* or a chachalaca would be ignored entirely. There has been little shooting of pigeons and doves. I did not mention the ocellated turkey because I think it is in danger of extinction or severe depletion. The ocellated turkey does quite well in certain places. In fact, in areas that have been logged or cleared, it tends to increase in numbers. I think that the time may come eventually when the ocellated turkey may be in danger, because as the number of people increase so will the number of firearms and the number of hunters; and in a long-term vision, it would probably be a good idea to learn more about the biology of this bird in order to anticipate proper management in the future.

North American waterfowl pass through British Honduras in fair numbers, but they are not hunted appreciably. Probably like many of the other areas under consideration, there are perfectly adequate game laws. There are laws which prescribe hunting seasons and the bag limits, but the problem is the universal one—how to enforce them. There are not enough wardens.

There are about 128 North American birds that occur in British Honduras at one time or another. On the winter range most of these North American birds are not restricted to a single habitat. There are exceptions, of course. Shore birds would be somewhat restricted. The yellow-throated warbler (*Dendroica dominica*) prefers the pine forest in British Honduras as does the black-throated green warbler (*Dendroica virens*), but in most species there is no particular preference for a single type of habitat.

In conclusion, agricultural practices, logging techniques, and hurricanes are the most important factors in altering the habitats in British Honduras. The areas of tall forests are the ones that have suffered most. These are the ones that are disappearing most rapidly. Fires are not often of considerable significance, although they may sometimes escape from the slash-and-burn areas during the dry season and cause some destruction. Second-growth areas in British Honduras are increasing in extent and probably will continue to do so for some time, and this includes growth of trees up to 50 and 60 feet high. Pesticides or herbicides are not a problem in British Honduras at this point, as there is practically no mechanized agriculture. Many nesting sea birds have disappeared from the keys.

It may be redundant to mention possible cures for these problems because I think that the solutions are very much the same in all areas under consideration. In British Honduras many of the remaining rain forest areas are government-owned, so it would probably be a relatively simple matter to set some of these tracts aside as preserves. I think if this were done with the intention of prohibiting logging, the benefits would be great and a minimum amount of enforcement would be required. I do not think there would be cause for concern at all about hunting if areas could be set aside and logging prevented. Probably some additional help for the nesting sea birds would be desirable, of the same type that has aided the red-footed booby. If only two or three of the islands that still retain colonies of sea birds were given refuge status, this would probably help the situation. It would be more difficult to educate the people about six or eight or 10 different endangered species.

It has been my impression that there are at least three basic problems. One involves the protection of individual species that may be vanishing or in need of some help. In other words, what can be done to help species A, B, or C survive. A second problem would be

the preservation of wild areas. This would involve the protection of all the species characteristic of the given habitat type. I think the third problem, and a more difficult one to solve, is the one of the overall ecological picture. If we set aside areas as preserves, certainly the birds that occur there and other animals that occur there would be protected over a long period of time. I somehow have the feeling that there are going to be crises of another sort before the birds are gone. For example, as areas are cleared, we have the problem of soil conservation, and I just wonder if the problems of watershed management and the problems of soil conservation are not going to be "snowballing" at perhaps a more rapid extent than some of the other things. I am not implying that we should forget about setting areas aside as preserves. Certainly, we should think strongly about education and some reforms in land use as well.

Discussion

IBARRA. Dr. Russell, knowing that British Honduras avifauna is quite interesting; knowing that the most outstanding and beautiful bird in that region is the ocellated turkey, whose beauty, man, 1,000 years ago, tried to capture in figurines, pottery, and sculptures; knowing for many years that the British are well known as conservationists, I would like to know if they have any law to protect such a bird, and tinamous and other game birds as well, for I understand that the populations of these small colonies of birds should increase. And, I take liberty to ask you a question: do you know about the existence of a protectionist law?

RUSSELL. The ocellated turkey is protected by law, but in practice this means practically nothing. If a hunter has the opportunity to take an ocellated turkey, he takes it and it's eaten. This is also true of other large game birds. I noticed no reduction in turkey numbers, even though they were hunted. I think that many of the natives, even people who live far back in the bush, are aware of the ocellated turkey and probably practice some sort of conservation without realizing, of course, that it is protected. They do not shoot every one that they can. There is a considerable amount of personal pride among British Hondurans over their unique birds. They realize that the red-footed booby is unique. They realize that the ocellated turkey is somewhat unusual. However, in the specific case of the ocellated turkey, I think it is in good shape because it prefers

second-growth situations. When rain forests are opened up, turkeys move into areas where they did not occur before, and the rain forest is certainly being cleared and opened now.

Tinamous are occasionally taken, but few hunters are expert enough to get them. I do not feel that there will be any reduction in numbers of these large game birds in the next few years. The guan is really the scarcest of the large game birds, but I think that it's holding its own.

As far as the human population is concerned, it is increasing steadily. The population in 1955 was about 65,000 and it is now about 100,000. I think that it is of great concern that most of the agriculture is still of the milpa or slash-and-burn variety and most people are dependent upon this type of agriculture. Thus tall forests are rapidly being cleared. Mechanized agriculture hasn't really gotten started there.

IBARRA. I agree that conservation laws should exist in British Honduras. I have found some books printed in 1932 referring with interest to this matter. These books were written by the famous Dr. C. L. Lundell, a scientist, and in the opinion of many one of the best botanists in America. He published a study on the Petén region vegetation, north of Guatemala, as well as Belize vegetation. He discovered many new plants and added a number of "belicensis" to the species.

Going back to the problem of the ocellated turkey, I must say that there is an urgent necessity to decree enforcing laws for the conservation of the ocellated turkey and other species. All this must be done before the situation becomes worse in the future, although you said something about measures being taken now.

RUSSELL. They have the laws but lack the means to enforce them.

IBARRA. The trouble seems to be that there is not enough authority to enforce the word of the law.

EISENMANN. Do they require the lumber companies to reforest? Do they have the usual Latin American laws? What plants of the same kind replace the ones that were cut?

RUSSELL. In the last year or two, the big mahogany exporters have been required to replant mahogany after logging. This is the only tree, other than pine, which is at all replanted. The forest department handles the pine reforestation and apparently the logging companies replant mahogany.

PETERSON. How often do major storms occur?

RUSSELL. They are frequent. Probably every 3 or 4 years a minor storm kicks up winds of 100 miles an

hour and brushes along the coast somewhere. I did not really give you a good estimate of the total extent of the damage of Hurricane Hattie, but probably half of the rain forest area in the country was at least partially damaged by the storm.

PETERSON. So this force of destruction is part of the natural quality then.

RUSSELL. Right.

HOWELL. I would like to know what ten species declined with the destruction of the rain forest.

RUSSELL. Let me point out again that my data are really inadequate for any major conclusions on this matter. The ten species that declined are: *Elanoides forficatus*, *Micrastur ruficollis*, *Amazona farinosa*, *Pipra mentalis*, *Rhytipterna holerythra*, *Lipaugus unirufus*, *Myiobius sulphureipygius*, *Turdus albicollis*, *Chlorophanes spiza*, and *Lanio aurantius*. The two species that increased were *Formicarius analis* and *Leptopogon amaurocephalus*, which surprised me.

WETMORE. What was the period of time of the hurricane?

RUSSELL. October 31, 1961, which was after most of the wintering birds had arrived and while some migrants were still passing through. I am not convinced that Nickell's data indicated great destruction of orchard orioles. It probably indicates a great dispersion of them.

The local people reported great mortality among conspicuous birds such as toucans and parrots. All of the large birds that are well known received some comment. They found them dead along the roadsides or in towns.

ALDRICH. Is there mention of *Tinamus major* among the rain forest species?

RUSSELL. Yes, but it was not one of the ones that I really had data to indicate change one way or another.

ALDRICH. Do you think that species would do all right in second growth?

RUSSELL. Yes. It would do fairly well in very tall second growth.

WETMORE. This species ranges in second growth that is several years old.

NOTE: Evidence of the return of northern migrants to identical winter quarters is provided in Walter P. Nickell, Return of Northern Migrants to Tropical Winter Quarters and Banded Birds Recovered in the United States. *Bird-Banding*, 39(2):107-116. 1968.

Avifauna in Panama

Eugene Eisenmann

It is with some hesitancy that I speak about birds in Panama. Although I was born and spent the early part of my life there, I have lived in New York for many years, and my visits to Panama, while frequent, have been for relatively short periods. The leading ornithologist working on the avifauna of Panama is right here in Washington, Dr. Alexander Wetmore. For those who do not know, let me say that he has just published the first of several volumes of his *The Birds of The Republic of Panamá*, a work of enormous usefulness to anyone interested in neotropical birds, for it attempts to summarize what is known of the biology of each species.

While Panama is a small country of some 32,000 square miles, its avifauna is enormously rich, exceeding in variety what is found in all the vast area of North America north of Mexico. As I figure it, the presently known bird species from Panama run to between 800 and 850, depending on whether you are a taxonomic lumpner or splitter. Regardless of the canal, Panama has reason to consider itself one of the major crossroads of the world. The great variety of birds is less the result of dramatic differences in climate and more the consequence of a geographic position, where North America joins South America and where the Pacific Ocean almost meets the Atlantic. In discussing bird distribution in Panama, it is well first to glance at the map, for owing to the bend in the continent, western Panama is adjacent to Costa Rica (and mainly Central American in its avifauna), and eastern Panama is adjacent to Colombia (and predominantly South American). The zoogeographical separation is emphasized by the absence of connecting high mountains (there are plenty of hills) in central Panama—which is what facilitated the building of the canal.

A large number of migratory species pass through or winter in Panama. The overwhelming majority of these are derived from temperate North America, Canada, and the United States; a few come regularly from southern South America. I shall not speak at

length about the migrant birds. As other speakers have suggested, compared with most resident species, the long-distance migrant birds tend to be more flexible in their habitat requirements, at least during the non-breeding period. The North American land birds regularly reaching Panama on migration are derived, with only a couple of exceptions, from east of the Rocky Mountains. A good proportion of these species favor coniferous forest as their breeding grounds. There are, I believe, no natural growths of conifers south of Nicaragua in the regions where these birds winter. Even on migration through North America such eastern land birds have to adapt to feeding in environments very different from their nesting areas. With certain exceptions, these migrants are less immediately vulnerable to the effect of human activities. Most of the smaller migrants can feed in border growth or partly cleared woodland. But it would be short-sighted to suppose that the extensive destruction of forest has no detrimental consequences to migrants. A number of migrant wood warblers (Parulidae), thrushes (Turdidae), and flycatchers (Tyrannidae), are definitely forest birds. Further, the sort of brushy growth with low trees that succeeds clearing on the Pacific slope provides little food for birds, either in the form of insects or fruit—which in the tropics many North American insectivorous species utilize extensively. Certain larger migrants, such as ducks, definitely have been harmfully affected by unrestricted hunting. The blue-winged teal and lesser scaup winter in good numbers in Panama. Data by the La Jagua Hunt Club, mentioned in Dr. Wetmore's book, plainly show a great falling off in numbers. The drop in native species of duck is even greater. This is the result, beyond question, of unrestricted hunting. Although the agricultural resources of Panama are smaller than in many of the Latin American countries represented here, as a consequence of the canal and the attraction of many North Americans, and of international capital, the standard of living is relatively high, especially about the more popu-

lated areas, enabling a great many country people to afford a gun and to buy shot. I do not want to suggest that Panamanians are bird killers. Generally what they shoot are birds they regard as edible game. To be sure, many small birds are captured for caging, but this (it seems to me) is an indication of a liking for birds. Boys do kill some birds with slingshots, but this is an educational problem rather than one really affecting bird preservation.

Generally speaking, I would say that at present the problem of bird preservation in Panama is mainly a problem of habitat preservation—and more specifically of forest preservation. Before turning to this problem, it is well to call attention to a few groups of birds that are endangered by direct action against them, rather than merely from the destruction of the essential environment. I have already mentioned the ducks. The cracids, magnificent game birds, are greatly reduced even in areas where suitable habitat survives near inhabited areas. I am speaking particularly of the great curassow (*Crax rubra*), the crested guan (*Penelope purpurascens*), and the black guan (*Chamaepetes unicolor*), a species found only in the mountains of Costa Rica and western Panama. In the reduction in numbers of other game birds, the two large tinamous (*Tinamus* and *Nothocercus*) and the wood quails (*Odontophorus*), destruction of the forest, I suspect, is playing a more important part than hunting pressure, for though the species are vocally conspicuous they are extremely furtive. The disappearance of macaws from most of Panama may be a consequence in part of capture for caging and in part of the removal of the forest trees on which they depended for food and nesting sites. Many of the eagles and larger hawks, notably the splendid harpy eagle, most powerful of all birds of prey, have been wantonly shot as easy targets; but again reduction of forest has greatly limited the habitat they require. The famous quetzal (*Pharomachrus mocinno*) still survives in the mountains of western Panama, and once its calls are recognized it is not too hard to find. The quetzal is steadily disappearing, partly because its resplendent plumage makes it a temptation, but chiefly because of the steady removal of the cloud forest on which it depends.

So we get back to what has been mentioned by previous speakers as the basic threat to bird life in the entire region under discussion—the rapid and widespread destruction of forest. Now, of necessity, man must cut down trees in order to grow the food to

which he is accustomed and to develop his culture. He did so in Europe rather gradually, in North America more rapidly; he is doing so in tropical America at present with extreme acceleration. The speed of forest destruction makes a great difference. It makes a difference to wildlife which is given no time to adapt to changing conditions. It makes a difference to the plant community by reducing the ability to regenerate. It makes a great difference in the destruction of the soil and the reduction of the water table, in promoting floods, and in creating practical deserts. Thus it affects man not only in reducing the attractiveness and variety of his environment but in the essentials of life.

From the viewpoint of birds the destruction of forest is much more serious in the neotropical region than in the temperate climates. Many forest birds are extremely local. One of the puzzles of neotropical ornithology is the fact that coupled with the enormous variety of species is the small number of individuals of many species. This is paralleled in the flora of the humid forest. Doubtless many tropical forms have a very restricted microhabitat, but in few cases do we know yet what that is. Rarely do we have the faintest notion of the limiting factors. The tropical forest is a many-tiered natural laboratory. Its thoughtless destruction means depriving man of a great opportunity to learn about his own environment, by studying the effect of seemingly minor variations on his fellow creatures. He may be exterminating plants that could be of inestimable value to his future well being.

One of the major conservation problems in Panama is this: as soon as a road is opened, squatters settle and cut down or burn all trees near the road. Within a very few years one must go a considerable distance to find forest. Owing to the nature of the tropical soil, the torrential downpours during the rainy season, the hilly topography, and the wasteful method of agriculture prevailing, the cultivated area is soon abandoned and a new area treated in the same destructive way. In Panama any unfenced and unguarded land is treated by the campesino as subject to clearing by him, whether it be public or private property. His ancestors have long practiced the same sort of agriculture, but the damage was less, for methods of destruction were primitive and only relatively small areas could remain cleared under then existing conditions. What Dr. Holdridge designates lowland "dry forest" on the ecological map of Panama is today not a forested region at all, whatever its climatic potentialities. In the lowlands of the Pa-

cific slope, except for the extreme east in Darien and the western part of the Azuero Peninsula, where roads have not yet penetrated, the countryside consists today largely of pastures or of scrub growth in overgrown clearings, interspersed with small subsistence farms and patches of woods along streams and steep hillsides or swampy hollows. The abandoned clearings doubtless represent areas where the soil is at present too depleted for the customary farming methods. If left unmolested, the land might recover its forest cover. But the traditional agricultural practice prevents a long enough rest for real enrichment of the land, and before long the brushy growth is burned and short-term planting is once more attempted. Unfortunately, the Agrarian Reform Code has unintentionally tended to reinforce uneconomic land-use methods.

A few comments on the Agrarian Reform Code seem in order, because essentially the same provisions appear to have been adopted in so many Latin American countries. I have here the code adopted in Panama; my comments refer specifically to that. The talk in Panama is that the main provisions were drafted in Washington and that their adoption was strongly urged by the Kennedy administration. Let me hasten to say that the spirit underlying the Agrarian Reform Code is commendable. The idea is to prevent monopolization of agricultural land, to promote ownership by the poor peasant, and to stimulate agriculture. Doubtless the preparation of the code was based on a belief that arable land was being kept from useful employment because owned by a few rich families. This was certainly *not* the case in Panama, where laws had long facilitated acquisition of ownership by the country farmer of the very extensive public lands, but where the nature of the soil and the traditional easy-going land and agricultural practices made it less arduous for the small farmer to move about than to cultivate intensively his own small plot. The Agrarian Code requires that landowners devote their lands to socially useful purposes. Expressly recognized is the value of forest conservation to preserve water sources, to prevent soil erosion, and for recreational and scenic purposes, including conservation of wildlife and stimulation of tourism. Seemingly, the code requires governmental approval to justify keeping private lands in forest. The language of the code, although not clear, is subject to the unfortunate interpretation that until the government has defined the forest preservation regions after agrolological studies, a landowner is risk-

ing expropriation if he fails to employ rural land for such "active" uses as cattle raising, cultivation, or lumbering. Allowing "fincas" to remain uncultivated and unworked is explicitly condemned. Yet most of the land on the Pacific slope whose most economic use would be reversion to "dry forest" has at one time or another been cultivated, hence might be called a "finca." Moreover, sound policy should encourage landowners to adopt forest preservation and restoration without waiting for, or being dependent upon, governmental action. It is to be hoped that in Panama, and elsewhere, the Agrarian Reform Code will not be interpreted to discourage natural regrowth of forest, on the theory that this involves leaving land unused. Under tropical soil conditions, especially in hilly terrain, reestablishment of forest is often the highest social use.

Even in the tropics regrowth takes a long time. But it has occurred in the past. Dr. C. F. Bennett, of the University of California in Los Angeles, has expressed the stimulating opinion that much of Panama which 25 or more years ago was forested, and some still forested today, was in Indian farm clearings when the Spaniards arrived in the 16th century; the conquest destroyed most of the Indian population and the country reverted to forest. I can say that bird distribution does give support to the view that at some stage in the Recent or late Pleistocene periods more unforested areas existed in Panama than say 50 or 100 years ago. There are a number of bird species found in open or semiopen country from Mexico to Honduras, sometimes to northwestern Costa Rica, which are wholly absent from Panama and most of Costa Rica, yet reappear in northern Colombia. Today the extensively cleared Pacific slope of Panama provides what looks like suitable habitat. It seems to me that at some not too distant period these birds must have had a fairly continuous range through semiopen country in Costa Rica and Panama, but that regrowth of forest later extirpated them locally. I doubt, however, that this distribution reflects simply the development and destruction of the primitive Indian culture. Rather, I am inclined to think, there was a cycle of drier climate followed by a cycle of wet. The drier climate facilitated the spread both of open-country birds and of Indian agriculture; the wetter climate made conditions disadvantageous for both. But whatever the extent of the aboriginal clearings in Panama, forested areas must have always remained

near, permitting rapid regrowth. The type of subsistence farming, the hilly terrain and heavy rainfall, and the lack of steel tools precluded too widespread and complete forest removal. It is modern equipment, modern transportation facilities, modern health and sanitation measures that have resulted in the very recent population expansion with all its new problems. Fortunately for Panama, while its land is subject to the special hazards of tropical soils on steep slopes subjected to heavy seasonal rainfall, there is yet no land shortage. Opportunities for agricultural expansion exist, provided cultivation methods are adapted to the environment. It is a pity that more research has not been devoted to the development of food from tree crops, for trees are the natural form of vegetation in this climate, and they tend to protect and enrich the soil, whereas the opposite tends to be the case of open cultivation of most herbaceous plants unless careful precautions are employed. Considering the abundant rainfall on an annual basis, it is a reflection of poor land use that in some rural areas there is now a water shortage during the dry season; even deep wells go dry. This is surely a consequence of permitting the hillsides to be divested of their forest cover, thus producing too rapid runoff and the lowering of water-tables. This excessive runoff has also produced destructive floods, not to mention the permanent economic loss from soil erosion. Many responsible Panamanians, including some political leaders, are aware of the value of forest; but in a democratic country it is hard to enforce effective conservation laws until the ordinary country people are educated to some appreciation of their necessity.

The situation should not be regarded as wholly pessimistic. True, the tradition brought from Spain favored an open landscape and showed less appreciation for forest than did the attitude of northern Europeans. But let us not forget that any new settlers in forested "virgin" country must clear very considerable areas of woodland to introduce the customary agriculture. We know, for example, that this occurred in the United States, and that even in the eastern, heavily populated states much acreage now regrown in forest was in cultivation a hundred or more years ago. To be sure, convincing the populace that certain lands are economically better maintained in woodland than in cultivation requires some education. But just as today we can destroy much more rapidly and extensively

than formerly, we can also educate much more quickly and widely.

Panama is a small country, and even the campesino reads the newspapers and listens to radio broadcasts issuing from the capital. Propaganda can be used to educate for conservation purposes as well as for political and merchandising reasons. In Panama everyone, even the remaining tribal Indians, is aware that this is a period of ferment and change. Everyone is receptive to learning and wishes to share in the benefits of the modern world. Science has enormous prestige. Hence even the common people are willing to accept ideas of land use that were unknown to their ancestors.

Most of us here are ornithologists interested in bird preservation. Our wish to preserve birds is a wish to maintain values we regard as important to ourselves as men. Our discussion has made it plain that preserving the marvelously varied avifauna of tropical America is mainly a problem of preserving varied habitats, particularly the exceedingly complex, and as yet little understood, forest environments. The preservation of large samples of natural forest areas means preserving an untapped resource of man whose potential values are as yet only faintly indicated or surmised. Regardless of the effect on the birds, man has a vital, long-range interest in not destroying the manifold resources that nature has provided.

Let me now discuss a few specific suggestions. Propaganda and publicity are not my field. I can only draw from my own experience. I believe that one of the most effective ways to create a public opinion in favor of habitat preservation is through the encouragement of an interest in birds. More people react with favorable emotions to birds than to forest, particularly the dark, humid, mysterious tropical forest. In the United States bird watchers have played a major role in conservation. Desiring to see a variety of birds, even the young "birder" soon becomes aware that this requires preserving a variety of natural habitats. Many of the professionals here assembled started in their youth as amateur bird watchers. This applies not only to the ornithologists, but to professionals in such fields as conservation, ecology, other branches of zoology, and botany, and even to the study of human populations (as I think Dr. Vogt can testify). Two of the presidents of the United States most active in creating national parks and wildlife reserves and in promoting conservation were active amateur bird students in their youth. The same has been true of many leaders in the

continuous battle to preserve natural environments throughout the country. Let me therefore urge the importance of bird identification books for Latin America. Until one can identify the commoner birds—give them a name—a serious amateur interest (much less a professional one) cannot even start. The Bible recognized that naming the animals was the first step to knowledge. Here in the United States we are so accustomed to our superb bird identification manuals that we take them for granted. These guides, and their predecessors used by the past generation, have been enormously influential in creating and maintaining a widespread interest in birds and an even wider public attitude that they merit protection. Such books are not yet generally available in Latin America. Printing of well-illustrated bird guides is expensive, and commercial publishers are disinclined to take risks unless wide sales seem assured. If bird preservation is of international concern, as we evidently believe, and is intimately tied to habitat preservation, then there is a real international interest in aiding the publication of good bird books for Latin America. Supporting this view, the International Council for Bird Preservation (Pan American Section) gave a modest subvention to the Instituto Miguel Lillo to aid publication of a very inexpensive Argentine bird guide by C. C. Olog. That book has completely sold out. Olog now has about ready to go to press the first volume of a general South American bird guide in Spanish, similarly assisted. This is only a modest start. What are most needed are inexpensive guides for individual countries or regions, so priced that they can be purchased by young people. Judging by experience in the United States, if many youngsters are exposed to bird identification activities a general atmosphere favorable to conservation will be developed and a certain number of ardent leaders will arise.

Conservation education should be provided in schools as part of courses in general biology and, at a more elementary level, in teaching understanding of the environment. The use of the radio, television, newspapers, and magazines to spread an appreciation and respect for "natural" environments goes without saying. The element of national pride in preserving unique or rare animals should not be overlooked. For those who are more responsive to economic considerations the touristic aspects should also be emphasized. Dr. Lehmann mentioned that he knew of some 30 or 40 North Americans who had traveled to Colombia this

past year simply to look at birds. Few of these people would have gone to Colombia had not de Schauensee's recent book on the birds of Colombia given promise that identification would be possible. The number of bird-watching tours to Latin America and elsewhere is constantly growing. One need only check such a journal as *Audubon Magazine* to be struck by the variety of such tours and of hotels and inns in tropical America advertising how many different kinds of birds will be observed by their guests. In that connection let me say that we should not be afraid of a little laughter when asked what we are doing with binoculars. A few years ago a group of Western bird conservationists visited Japan. Dr. Yamashina (who is a grandson of the Emperor Meiji) was the leader. At almost every town we were met by journalists and welcomed with speeches in Japanese by the local mayor or the provincial governor. These activities after a time might have become a little wearing, had not Dr. Yamashina explained that the publicity provided was a way of advancing conservation in Japan.

Now, let me turn to the question of nature reserves and legislation. I believe it is highly desirable that all the Latin American countries presently set aside substantial areas as national and provincial parks and nature reserves. I realize that in some countries effective protection may not yet be feasible because budgets cannot support a force of wardens. Doubtless squatters may invade some areas and commercial lumbering outfits may disregard the public rights. But at least the land will be there, reserved for public recreational and wildlife and forest protection purposes. A future generation, perhaps the next, may be more able to enforce its rights. If we wait, the land may have been cut over and appropriated for other purposes, so that it will be more expensive, or at least more difficult, to turn over for nature preserves. In Panama most of the land that should be set aside is government owned. Unless soon reserved, it may be taken by settlers under the homestead laws. For with every mile of road built, the destruction of many square miles of woodland near the road almost immediately follows. The question of reserves set up by other organizations has been raised. Usually it may be best to place such private reserves in the hands of local or international organizations. But I feel sure that no reasonable Panamanian objects to financing from the United States. Panama is accustomed to this; and people do not ordi-

narily turn down financial assistance for a good cause when it costs them nothing.

Conservation laws and regulations regarding hunting, forest destruction on slopes, water sources, and roadsides are urgently needed. Again, I realize that the laws may not be adequately enforced at first, but if they are reasonable, in time they will be enforced. And the very existence of the law has some educational effect. Let me say for Panama that it is one of the few countries that in its national constitution expressly recognizes the importance of conserving its native flora and fauna.

Finally we should aid and encourage the development in Latin America of native biologists, ecologists, and conservationists. Their number is growing, but in some countries they work alone. They deserve help. Things are not so hopeless as some might suggest. A good cause is never lost until we cease to fight.

Discussion

IBARRA. We have mentioned the word "education" several times now. Since 1964 my country has had a television program on conservation. This program has been successful in educating people. I wonder if similar programs, helped by articles published in newspapers and magazines, would not have the same results in Panama as well.

EISENMANN. There are individuals who write occasionally on conservation, but there is no regular conservation or natural history publication in Panama. The Agrarian Reform administration has published occasionally in the field of forestry, soils, and land and water conservation. Panama has been fortunate in attracting foreign scientists. It has the Canal Zone Biological Area operating the world-famous Barro Colorado Island. Dr. Moynihan, who is in charge is at this meeting. He has a staff of biologists. The presence of this and other institutions, financed in the United States, attracts many scientists. There is a constant influx to Panama of biologists, and amateur bird students, too, from many nations. I regret that this has not been publicized in Panama as much as is desirable. It would be useful if the people of Panama were frequently told that the natural flora and fauna of the country was an attraction to visitors. The newspapers are glad to publish information on visiting scientists, but visiting scientists are understandably reluctant to take the initiative to publicize themselves. Panama does benefit because of the constant stimulation of visiting

scientists. I should guess that, relative to its population, a larger proportion of Panamanians has received advanced education in biology and allied disciplines than the people in other Latin American countries. For example, at the Gorgas Memorial Laboratory in Panama there are several native Panamanian scientists working in a field that at least impinges on bird conservation. Several have become, partly through the guidance of Dr. Wetmore, quite competent ornithologists. In the field of medicine Panamanians are internationally known.

BUCHINGER. I was just wondering about what was just stated. Perhaps as an example, we can mention that there is a forester in the ministry of agriculture in Panama who was sent to IICA (Inter-American Institute of Agricultural Sciences) in Turrialba to study. His thesis was naturally related to his home country: he was asked to work on an ecological survey of Panama and to point out which areas would be most suitable for national parks. After he finished his study and submitted it to his office last year, Dr. Lehmann as president of CLAPN (Committee of Latin American National Parks) received a letter from the Minister of Agriculture in which he stated that Panama is planning a new forest law. The FAO has sent a specialist to advise them and now it is planned to include in the forest law references to national park legislation based on the ecological survey which was made by Ing. Gutiérrez. I think this is a good step in the right direction and proves that the governments in Latin America are interested in and willing to work for conservation matters.

EISENMANN. Maybe Dr. Holdridge could tell us, because a lot of the forest ecologists working down there are working with his methods. Do you know what the situation is?

HOLDRIDGE. My brother wrote me that a forest law has been planned.

BUCHINGER. When the forest law project was finished it was not sent to congress, because at that time the government had become convinced that the legislation had to deal at the same time with all natural resources. Water, soil, and park legislation will have to be considered at the same time.

The Minister of Agriculture encouraged Ing. Gutiérrez to study conservation in Turrialba and also to take a short course for park administrators in 1965 in Michigan. His excellency Dr. Carles has also officially asked three times for a forest ranger training course. If na-

tional parks are established, there must be people to guard them, and also interpreters to explain to visitors the importance of the parks. The minister would even be able to budget a warden system, since he thinks that what it costs to maintain those wardens would come into the budget through the promotion of tourism, or at least it would be possible to train otherwise unemployable natives.

The conservation movement development can be compared to the planting of the seeds—you do not see the fruit of the tree next day. We have not only to be patient but very much aware of those good things which are happening in Panama. A pat on the shoulder of the authorities is also needed since, as the minister is a politician, as you know, if he does something which is good and he gets publicity, it enhances his public image and makes it worthwhile for others to follow the trend.

But, as you remember, Porfirio Gómez, the late director of the Agrarian Reform, was very much worried about what is going to happen to the forests in the Canal Zone, and he said it would be a great help for the Panamanians if those forests could be protected while they are under U.S. ownership. So we visited with Governor Fleming to discuss the matter. As a general rule politicians are rather negative about interfering with what should happen to natural resources. Not so Governor Fleming, because he is also a conservationist and a dedicated bird watcher. He promised that if he receives a proposal defining why this area would be worth saving, he would forward the memorandum to Dean Rusk. A map and a description of the areas worth saving was needed. We then went to the Smithsonian and asked that this proposal should be written up because, naturally, such a memorandum to the U.S. governor has to come from a U.S. office, it cannot come from the outside. As you know, along the pipelines and on the higher slopes there are some beautiful forest stands worth saving and I do not think it was such a big thing we were asking for. For different reasons, evidently, nothing was done in this matter, and this was worrying the employees of the Agrarian Reform in Panama since some Panamanians are already asking for this land when it is returned to Panama to use the timber. Naturally it would take money to buy lumbering equipment, but U.S. businessmen promised the funds, especially a New York company which is backing the Panamanians' request to deforest the land after the return of the Canal Zone. One consequence

of the deforestation would be a water shortage in Panama City. And obviously the birds' habitat would be endangered. Scientific pressure to point out these possible losses would be most welcome. If not the Smithsonian, perhaps you could suggest another U.S. group which might ask the governor of the Canal Zone if he could not consider putting those areas under special protection and declaring them as national forests. When this area is turned over to Panama nobody should have to feel that a good thing had been wasted. I mean the Agrarian Reform of Panama could refer to the importance the United States gave to the lands and be in a better position to save the forest and not to divide the land.

EISENMANN. There is one thing that should be mentioned in regard to Panama. Today if you drive on a road in the lowlands of Panama, about the only area where you get forest adjacent to the road is in certain parts of the Canal Zone. In several reserves within the Canal Zone the forest is definitely protected. During the past few years the talk has been that the present U.S. administration is negotiating with Panama for cession of those parts of the Canal Zone not required for canal operation or direct military security. For the benefit of the people of Panama it is most desirable that some areas of the Canal Zone still in forest should be maintained as nature reserves. Arrangement prior to cession should be made with the Panamanian government on this question. Once cession has been effected, the government of Panama will be under great internal political pressure to turn all accessible areas into private hands for more immediately obvious economic uses. There is no national park in this part of Panama, nor any large park at all anywhere in or near the cities of Panama and Colon, where much of the population of the country is concentrated. Even Barro Colorado may be endangered, for it is an island in an artificial lake. If a sea-level canal is built in the present Canal Zone area, the lake may be drained and protection of Barro Colorado would then be difficult and its attractiveness destroyed. There are other wooded areas in the Canal Zone, now military reserves, that actually are superior to Barro Colorado from the viewpoint of the variety of animals. I therefore hope that arrangements with Panama will ensure protection of forest, and thus of the wildlife, in these areas.

MOYNIHAN. Could I just add a few words about the local situation? Of course, political relations are a little tense at the moment. We hope that we will be able

to maintain the reserves we have now. I am afraid, however, that we may lose everything if we ask for too much more.

BUCHINGER. I do not think that you should ask for them to have them in the ownership of an Institute. If the area is declared a national forest it does not mean that it is going to remain under your control. We ask you only to evaluate them. Just survey those areas, the same as you describe herbarium samples. For example, many of our nature conservancy projects here in the United States are now being declared national historical monuments. And nobody wants the Smithsonian to manage the forest in the Canal Zone; this would be a very unpolitical action. All that is needed is a declaration that those areas are interesting scientifically, so much so that the U.S. military and the Armed Forces in the Canal Zone are not using them as they are declared to be national forests. There would not be anything for the Smithsonian to worry about. It would be just good scientific testimony that the lands are worthwhile saving. Latin American countries accept the value judgment of developed countries and at the same time they are somewhat skeptical about international laws because everybody knows that it is impossible to implement them without an international law enforcement agency. We therefore only ask U.S. agencies to truthfully state the values of the forests and, as mentioned before, I feel it is even much better if the United States agency does not handle the land—it should not have anything to do with the Smithsonian. At this point, it is sufficient to state that the area is interesting for bird refuges and national forests. Then give the Panamanians a chance to continue your work. You are not telling the Panamanians what they should do with the forests *after* they have them under their jurisdiction; this indeed would be interference. You are only doing your best to state the value of the area and point out the disastrous consequences of deforestation.

WETMORE. May I say first that I think my good friend Dr. Eisenmann was more than a little complimentary to me. I know of no one who has more detailed knowledge of the bird life of Panama and of its distribution than he has. This is witnessed by his publications. I have found these highly useful in my own work and studies. What Dr. Moynihan has just said

is very much to the point. It is inopportune, in my opinion, at the present time to try to make additional reserves in the Canal Zone area, as this would be completely misinterpreted in the republic. I do not have any real fear for the future of Barro Colorado Island. I believe that it will be preserved. And I believe that some other areas that are valuable for the conservation of wildlife will be held by the military in such a way that they will remain as reserves. Certainly whatever treaties are made, and rumor is that there are to be three, one of them will concern the military establishments in the present Canal Zone. Certainly the military are not going to give up territory necessary for protection against any outside aggression.

The other thing that has been mentioned is the boy with the slingshot. The accuracy of aim in many of them is fantastic. The slingshot really became common when castoff inner tubes of automobile tires became available. This was a source of rubber, but it was not too widespread. I mentioned earlier in this meeting that I have recently returned from a winter in Panama. I was intrigued to note that every small boy that I saw along the road, from the towns to the remote areas out among the squatters, carried a slingshot. I found to my surprise that enterprising manufacturers now are furnishing rubbers, already prepared, to make slingshots. They are on sale in the little stores all through the country for five cents a pair. These boys are killing many small birds. I was amazed at how accurate they were. I recall very well one boy who joined me casually when I was occupied in collecting birds for scientific specimens. This youngster killed at least one bird for every two shots, from hummingbirds to small pigeons.

What Dr. Eisenmann has said about education in Panama is very much to the point. Among the squatters on the small farms, it was usual to find a man who was barefoot, dressed only in a shirt and a pair of trousers, but able to read and write. Those of middle age especially were thinking individually. As Gene just said, individually they are friendly, but as a nation they do not care for us. I really think that, as Gene has said, there is a great deal that can be done in Panama in education in conservation matters. He has made an important statement.

Avifauna in Nicaragua

Thomas R. Howell

Nicaragua is bordered on the south by Costa Rica and on the north by Honduras and El Salvador, and it extends from the Pacific Ocean to the Caribbean Sea. It is the largest of the Central American republics, but I am uncertain of the exact area, as the World Court decision of 1960 recognized the line proposed by King Alfonso XIII as the boundary between Honduras and Nicaragua. This put some areas claimed and occupied by Nicaragua into Honduras. (As Monroe never tires of reminding me, this transferred some of my best specimen records from what used to be northern Nicaragua into his domain.)

Nicaragua may be divided, geographically and ecologically, into two slopes and several divisions. There is a relatively arid Pacific slope and a wet Caribbean or Atlantic slope. There are highlands in the north-central area that extend from the northern boundary south to the valley of the Río Grande de Matagalpa, and there are isolated volcanic peaks in some otherwise lowland regions. Elsewhere, the country is of low relief, and there are two large lakes in the southwestern sector. For purposes of this presentation, I will designate habitats in general and popularly used terms. The categories of the Holdridge system of vegetation classification into which these Nicaraguan areas best fit are given in parentheses.

Most of the Pacific slope lowlands were originally covered with broad-leaved forest (much of it deciduous) in more humid situations, thorn scrub in the more arid localities (roughly, tropical dry forest and tropical very dry forest, respectively). At higher elevations, up to about 4,000 feet, there is either broad-leaved forest or, in the north-central highlands, pine forest (mostly *Pinus oocarpa*). This pine forest seldom extends below 3,000 feet. Above 4,000 feet there is usually cloud forest (premontane wet forest). The Caribbean slope lowlands are largely covered by evergreen rain forest (tropical moist forest and wet forest), but the equal humid northeast corner of Nicaragua includes a lowland pine savanna in which the elevation seldom

exceeds 400 feet and where only one species of pine, *Pinus caribaea*, is present. There are interdigitations and islands of rain forest along watercourses and in low, wet areas within the savanna.

The two great lakes, Lake Managua and Lake Nicaragua, are large but relatively shallow and likely to be rough as they are almost constantly swept by winds. This turbulence, plus the silt washed into them from many small streams, means that the lakes are always turbid or muddy. They lie almost entirely within the more arid Pacific slope except for the southeast section of Lake Nicaragua, which drains to the Caribbean by way of the Río San Juan. There are no extensive marshy areas around most of the lake shores.

This provides a brief outline of the major kinds of habitats that are found in Nicaragua. Now let us examine the effects of human activity on both the migrant and resident species of birds in each of these habitats. On the Pacific slope one finds certain migrant species that breed in the western part of North America. For instance, around the city of Managua one of the most abundant birds in the winter is the scissor-tailed flycatcher. It is present in enormous numbers and the air over the city is virtually filled with these birds at sundown as they go to their roosting places. Other winter residents include the western tanager, which is numerous in the lowlands of western Nicaragua. In the north-central highlands, one may find the Townsend warbler and hermit warbler occupying the pines of that region. On the Caribbean or Atlantic slope one finds wintering birds which breed in eastern North America, such as many of the warblers, for example, hooded, Kentucky, chestnut-sided, and magnolia warblers. Some of these are also found on the Pacific slope. As a rule, one does not find birds of western North America on the Caribbean slope of Nicaragua, but some breeding species of eastern North America are found as migrants or winter residents over both slopes of the country. Migratory waterfowl are present in moderate numbers at the appropriate season on numerous small

lakes, ponds, and lagoons throughout the country. The two great lakes do not support large populations of waterfowl, possibly because conditions on and around the lakes, as described previously, are not especially favorable.

The Pacific slope has been very much affected by agriculture, in particular since the late 1940's. Following the end of World War II, two North Americans came to Nicaragua and planted cotton. This was a tremendous financial success and, needless to say, encouraged a great boom in cotton planting which had not existed before. A great many areas were cleared for planting of cotton and much of the forest that persisted into the 1950's is no longer present. Almost every wooded section of western Nicaragua that would be suitable for cotton growing has been or is in danger of being converted to this purpose. With the sudden advent of a new crop of this kind the characteristic insect pests did not make their effect obvious immediately, but after a few years the boll weevil was present in destructive numbers along with other kinds of injurious insects. As a result, as Vogt has pointed out in reference to other countries, tons of insecticides are sprayed every year over the cotton fields of western Nicaragua. The effects of this are difficult to assess because we do not have any accurate figures or estimates on the numbers of birds that were originally present or how many there are now. It certainly seems obvious that this constitutes a very clear and present danger, not only because the quantity of insecticide sprayed over this region is enormous, but because it filters into streams that drain into the two great lakes where the effects may be felt for a great many years to come.

In the city of Managua there is a small museum, the Museo Nacional, founded by Diocletiano Chávez, which includes many mounted specimens of birds that he collected in the vicinity of Managua about half a century ago. On looking at this collection one is struck by the great number of large raptorial birds which used to occur but are no longer found in this region. This is a result of clearing of the forest, first for planting of coffee in the moderately high elevations and later for planting of cotton in the lowlands. It also goes without saying that the large galliform birds have disappeared from most of this area as well. Such species as the great curassow (*Crax rubra*), the crested guan (*Penelope purpurascens*), and to some extent the chachalacas (*Ortalis*) are greatly reduced, although the chachalacas are rather a resilient group and seem to do

rather well in second-growth areas even under fairly heavy pressure. Apart from large-scale coffee and cotton growing, there has been long-term destruction of the original Pacific slope forest for small-scale farming and for extensive cattle grazing. Thorn scrub is most likely to become established in overgrazed areas, and this type of vegetation has doubtlessly increased and extended into places where there was once broad-leaved forest.

The pine-forest birds of the north-central highlands have probably not been very much reduced by the presence of humans in this area. However, logging has certainly had effects on the habitat as has fire, but I think it is reasonably safe to say that the existence of these birds is not seriously threatened by the effects of human habitation and use of this region. The cloud forest is another matter, of course. This habitat disappears as rapidly as it can be cut for the planting of coffee, which is a very important cash crop in the economy of Nicaragua. Since there are not too many areas in Nicaragua of high enough elevation to support cloud forest, this does represent a serious problem and I need hardly emphasize again the fact that what is needed is the preservation of the habitat. If the habitat is preserved then the characteristic avian species such as the quetzal (*Pharomachrus mocinno*), the three-wattled bellbird (*Procnias tricarunculata*), and various others that are found in this region stand a chance. Without the habitat they stand no chance whatsoever.

The Caribbean slope rain forest has been cut very extensively where it is accessible. Until very recently, however, there was no communication except by airplane and by dugout canoe or mule trail from the Pacific slope to the Caribbean slope. A road has recently been completed after many years of work which connects the western part of Nicaragua with part of the Caribbean slope along the Río Escondido, and this will inevitably open up more of the country. As one flies across from one coast to the other, one is impressed by the frequent patches that have been cleared along the rivers for planting of bananas, corn, and beans. There is no question that the disappearance of the forest will continue and will be accelerated as time proceeds.

The lowland pine savanna has been extensively lumbered for the last 40 years, and most of the trees that remain are small ones, perhaps about 70 years old. Also, the area is subjected to periodic burning. Every dry season the local people set fire to the grass in order to clear away the coarse dry growth and allow tender

new shoots to come up and thus provide some food for cattle. Some of the fires may begin through natural causes such as lightning; in any case there is extensive destruction of seedlings. The seedling pines grow up in great numbers if they are not destroyed by burning, and a very dense growth of small pines quickly appears. A certain amount of burning may be desirable, because in areas protected from fire one finds a very dense cluster of exceedingly spindly seedlings; a healthier, more vigorous forest would probably result if there were some thinning out at an earlier time. Characteristic ground-dwelling savanna birds such as the black-throated bobwhite (*Colinus nigrogularis*) and common meadowlark (*Sturnella magna*) are very abundant despite burning, and these species could not exist in thick forest.

The sum total of the effect of human activity on bird populations in Nicaragua is not very different (if at all) from that mentioned for Honduras and British Honduras and undoubtedly for other regions. My impression is that the migrant passerines have not been affected detrimentally by the kinds of human activity that we have discussed here. Certainly they do utilize primeval forest, but without the primeval forest the migrants seem to be equally abundant, and it would not appear that destruction of the habitat on the wintering grounds is anything remotely approaching a limiting factor in the populations of these birds. The migratory waterfowl are hunted very little in Nicaragua, and in fact there is little sport hunting of any avian species. Very few Nicaraguans use shotguns, and only those with shotguns hunt quail, which are very abundant both on the Pacific slope and in the pine savanna region. Most hunting is done with a rifle by pot hunters, and a rifle is not a very effective weapon for hunting birds other than the largest game species. As mentioned yesterday in one of the talks, many of the lumber camps and mining communities employ local hunters whose job is to go out and secure meat for the camp. These men are mostly after deer and other large edible mammals, but naturally they take any of the large game birds, such as the curassow, the guan, and perhaps chacalacas and pigeons. In Nicaragua there is no extensive shooting of just any bird that happens to be big enough to use in the cook pot, as there is in many other parts of the world and some other parts of Latin America for that matter. Thus, the results of shooting are not serious as compared to the destruction of habitat, but shooting does have local effects on the populations of the large edible species and possibly the large

raptors. Among those who make shooting a conservation problem are some North Americans who come to work in Nicaragua. These people are often rugged outdoorsmen who like to use a gun and regard freedom from hunting and shooting regulations as one of the fringe benefits of their jobs. Some are real sportsmen, but others are inclined to take shots at any large or colorful bird just for target practice. Although this may not have serious effects on the total population of any species, it is a distressing thing and does nothing to aid the cause of conservation in these areas.

What about the species that might be endangered in Nicaragua? There are only three species of birds that are more or less confined to this country. These are the little pearl kite (*Gampsonyx swainsonii*), which inhabits the western part of Nicaragua, the Nicaraguan grackle (*Cassidix nicaraguensis*), found around the vicinity of the great lakes, and the little-known Nicaraguan seed finch (*Oryzoborus nuttingi*) which is found only on the Caribbean slope in wet meadows. The pearl kite is apparently the same subspecies as that found in northern South America, but the other two are usually considered distinct endemic species, although some authorities feel that the seed finch is conspecific with *O. crassirostris* of South America. The pearl kite, I would guess (and this is only a guess), is in danger of being affected by the spraying of large quantities of insecticides over the cotton fields of western Nicaragua. Since it feeds largely on insects and very small vertebrates—organisms in which these insecticides tend to accumulate—the kite would be a likely victim of any deleterious effects. The seed finch is a little known form, and I would only be guessing if I said anything about the effects of human activity on its numbers and its range. These might even be increased by human activity, since the bird is an inhabitant of open areas and not forest. The Nicaraguan grackle, the only unquestioned endemic species, is abundant and has probably increased its range as a result of human activity. It associates very closely with cattle, and wherever one finds cattle around the two great lakes one usually finds this grackle. As certain areas around the lakes have been cleared for pastures, the grackles have extended their range and will undoubtedly be found in northern Costa Rica before very long. In brief, the grackle is certainly in no danger at the present time.

Now, I would like to say something about the prospect for preservation of habitat and animal life in Nicaragua. The problems are very similar to those

that the other speakers have discussed—land is cleared for agricultural or commercial purposes at an accelerating rate, with generally predictable effects on the fauna. Political and economic conditions are of paramount importance in this situation. In Nicaragua, which lacks most of the resources necessary for industrial development, most of the real wealth is ultimately derived from agricultural and forest products. This means, inevitably, that those individuals and families with large holdings of land play key roles in the economic, political, and social life of the country, and these people are naturally extremely influential in matters of public policy. I believe I would be justified in saying that whether or not areas representing different kinds of habitat are preserved depends largely on the position of these influential groups. If preservation of certain natural areas has the support of particular Nicaraguan leaders, this can be done. Without their support it will not be accomplished. The question becomes, then, how can those in critical positions of authority best be appealed to for the cause of conservation? I think that the most hopeful prospect is an appeal to national pride. Nicaraguans in all walks of life, irrespective of their political affiliation, are intensely patriotic and proud of their country. By way of illustration I would like to mention the poet Rubén Darío. He was born in Nicaragua in a little village since renamed for him, and although he lived most of his life abroad he returned to his native land to die and is buried in the city of León. This man of letters is unquestionably Nicaragua's greatest national hero; there are statues and portraits of him everywhere and his name appears wherever printed words are found. All this points up the fact that when there is something or someone for whom national pride can be aroused, a great deal of popular and powerful support can be developed. If there is some way that national pride could be associated with the establishment of national parks or preserves of some kind, I think that much could be accomplished. This will require at the very least the active support of the leaders mentioned previously as well as the cooperation of the citizenry at large.

Discussion

ALDRICH. It had been mentioned several times now that in different countries there does not appear to be the likelihood of an effect of habitat change on migra-

tory birds of North America because of their tolerance for varieties of habitat. We have not distinguished, as I recall, between birds which are actually in progress of migration and those which have reached their wintering grounds and have become fairly static as winter residents. We are beginning to hear more and more about territorialism in birds on their wintering grounds, similar to that on their breeding grounds. I am wondering, in true wintering habitat due to this business of territorialism, whether there would be more restriction of tolerance of habitat than when the birds are migrating. Maybe that situation would be obscured by the movement of migrants through wintering areas of the same species.

HOWELL. I would say certainly this is a possibility. In Nicaragua at least there are very few resident species of warblers that would seem to be competitive with the North American migrants. About the only specific instance of competition that I can think of is in the pine areas where the Grace warbler shows very distinct aggressiveness toward the wintering species. Those found in Nicaragua do not seem to have any competitors among the resident species that would appear to affect their numbers to any great degree. In other areas farther north and perhaps farther south this may not be the case. As pointed out, scissor-tailed flycatchers are extraordinarily abundant as a wintering species in western Nicaragua, and they are, in contrast to their activity on the breeding grounds, extremely social. As I think everyone here knows, the scissor-tails will, on their breeding territory, sometimes fight to the death, whereas in the wintering area one can see trees with large numbers of scissor-tailed flycatchers and tropical kingbirds roosting next to one another, and the situation is very markedly different from what we are accustomed to on the breeding grounds.

ALDRICH. I was not talking so much about competition among species for territory but, rather, the selection of habitat for territory.

EISENMANN. The fact was mentioned, and it is certainly true, that the winter range of the migrant western birds usually ends around Nicaragua. Is that not, perhaps, in part a consequence of the presence of pines? Most of the western birds, except for the open country birds, follow the pines, which range south only to Nicaragua. Now, if you cut down the pines, is not that going to affect the winter habitat?

HOWELL. What I intended to say was not that the western forms are necessarily limited to Nicaragua and

extend no farther, but that there are certain species which are migrants from western North America that are found only on the Pacific slope in Nicaragua. None of these characteristically western species also occupies the Caribbean slope, whereas a number of the forms from eastern North America that winter on the Caribbean slope also flow over and occupy the western part of Nicaragua as well. Now as for the cutting of the pines, in this region the larger pines are already cut, but there is not much interest in the small ones and these are left alone. Those that are too small to cut for lumber are, nevertheless, quite adequate for the needs of the wintering warblers and other pine-forest species. For example, in the savanna and also in the montane pine forests in the south-central highlands, which have been pretty extensively cut, one still finds species such as the red crossbill and a number of very characteristic pine-forest birds. The Grace warbler, which never goes out of the pine trees, is very abundant in these regions and there is, it seems to be, little danger that the pines will disappear. Rather, the pines seem to do very well when everything else is gone. They will grow on soils that have been eroded or de-

pleted and will not support some of the other kinds of forests; and again, as has been previously mentioned, there is a body of opinion among plant geographers and ecologists that the pines, both in the highlands and especially in the savanna, owe their existence to human disturbance, to cutting and burning by aboriginal Indians. I think this is more likely to be the case in the savanna than in the highlands, but nevertheless the extent of the pine forest in northern Nicaragua does correspond quite closely to the historical records of habitation by the Spaniards in earlier periods, and also where they found Indians occupying this region. Now, whether they were there because the pines were there or whether they are responsible for the presence of the pines, I could not say on the basis of what evidence there is. But the point is that, at least in Nicaragua, pine forest and human habitation do not seem to be at all incompatible, and there is at least some interest in preserving the pines as a resource.

This one of the very few conservation activities that is going on—protection of pine areas from burning to allow seedlings to come up and renew the crop of trees.

Mexico: Avifauna and Modification of Habitat

Rodolfo Hernández Corzo

The General Development of the Country

Mexico is now undergoing a very dynamic transformation; and, of course, not one following a uniform pattern. Its rate of demographic growth (3.3 percent per year) is certainly among the highest of the world, and probably the highest for Latin America and the continent. As seems to be the general trend, population, and especially redundant population, tends to concentrate in a few very large cities, notably in the capital of the country. Mexico City has now more than 6 million inhabitants, and cities like Guadalajara, Monterrey, Morelia, or Merida, all of them state capitals, are really large by any standards. Mexico City, however, monopolizes about one third of the general social, economic, financial, and cultural resources of the country.

Parallel with population growth, industrialization and technicalization of agriculture is rapidly extending. Most large cities are industrial centers, and they act as centripetal forces, attracting people looking for jobs or opportunities for a better life. Simultaneously, mass production in agriculture due to the application of new technology and, also, certain deficiencies in the implementation of the principles of the agrarian revolution are causing a gradual depauperization of the peasants, which accelerates the continuous flow from the country to the main urban centers.

On the other hand, the close contact with the United States produces a strong "demonstration effect." Mexican people become every day more aware, and ambitious, with regard to modern technological conveniences, even in the country. They look for radio and television sets, washing machines, and automobiles. They look for more education, social, and health services. It is enough to remind you that the National University in Mexico City is already an impressive center, bursting with 80,000 students, and the National Polytechnic concentrates 65,000, also in the capital. There

are 24 state universities and more than 30 technical schools of different sizes and academic standards, but the pressure of the demand for scientific and technical preparation is constantly mounting.

Industrial production is growing at an average of 7 percent per year, and agricultural production at 4 percent. These rates fluctuate from year to year, but a very notable consistency is appreciated in the late and more stable years. Productivity is also in the ascent, more rapidly for industry than for agriculture, but it is still low for the needs of the country. Average personal income was calculated at 370 U.S. dollars per year in 1964, but this average comes between extremes widely apart. This is why we can see very large modern cities like the capital and others, along with hundreds of poor small country villages, where people of very low productivity try to make a living. There are families for which the per capita income is comparable to, or even better than the U.S. averages, and there are other people scarcely making \$100 per year. Highly educated scholars on the one extreme, and still about 30 percent of the population not reading and not using electricity or newspapers on the other side.

This is the general picture. A panorama of contrasts. In some regions, sharp contrasts indeed. And this is the background which has to be considered, and clearly understood, to judge the present style and methods for the utilization of the resources of the country. Nevertheless, under the forces of this active transformation, it may be advanced that the general trend is positive, although local or regional situations may arise.

Conservation in Mexico

The country is now much more aware of the meaning of its natural resources and the need for a wise utilization of them than it was a generation ago. This is especially true of renewable resources. Mexico no longer rests on a few mineral products (for almost raw

exportation) as was the case in the last century. Production diversification is the general trend now, as well as industrial transformation to raise standards of living.

The wise use of land, water, and forests has been the subject of strong official concern; but we are still learning and trying to adapt scientific techniques of resource management to the mounting pressures of such a rapidly growing population. It is said now that there are three phases in resource utilization: (1) Total harvesting or exploitation, as though the products of the land were to last forever; (2) the reactions of conservationism and preservation of resources, trying to protect what is left from the phase of destructive use; and (3) scientific management, to obtain the best of all available resources for the better satisfaction of human needs. Mexico, generally speaking, is still coming out of the first and into the second phase. Conservationism may still be judged, in certain quarters, as a romantic movement, of more academic significance than practical results. A strong battle is fought between vested interests and the ideas, and ideals, of our more renowned conservationists. Tom Gill and William Vogt know this very well, and have written books and spoken frequently in wide circles to warn Mexican people against the rapid destruction of the natural resources of the country which threatens, perhaps, its own self-destruction. Their educational results, along with those of the Mexican conservationists like Beltrán, are very valuable. They have produced a wise and well-prepared generation of scientists and engineers strongly convinced of their professional role.

But what they are doing, highly significant as it is, is not enough. In a country with the demographic pressure that Mexico undergoes now, where the rural population is the more rapidly growing sector, the efforts to open new land for agricultural use and to raise productivity are confronted with the reality that productive lands are more and more scarce. If rural populations still represent 47 percent of the total—42 million people—with a very low level of living, and looking for jobs on the other side of the border, it is clear that any conservation movement will have to fight against apparently insurmountable problems.

On the other hand, we have the effects of urbanism and technicalization, the continuous opening of new roads (between six and eight hundred miles per year of first class, and a considerable mileage of local roads), the growing application of machinery, pesti-

cides, and other chemicals to the land, and other similar signs of a progressive civilization. The conclusion is rather simple. The available natural resources, especially the renewable resources, have been used, and, in some places, abused at a rate higher than the natural restoration capability. It looks as if land, streams and lakes, forests, and even vegetation of marginal value, are shrinking before our eyes. The natural foundation of the country is rapidly deteriorating. The environment for human life is no longer the land of great green mountains everywhere, clear lakes swarming with wildlife, beautiful skies, and jungle-like tropical forests. Today, along with economic development, many cities of Mexico partake with other great cities of the world the privilege of smog, pollution of air and streams, dust storms, and mounting deterioration of the general environment.

It is thus clear that the solution cannot be found only in the ideas and techniques of conservationism as it used to be understood. These cannot be easily taught to hungry peasants or progressive and aggressive industrial entrepreneurs, both profoundly ignorant of the natural values and interactions of living things. Perhaps, since time is short and needs are growing, the more effective solution could be found in skipping the second phase and going right to the third: scientific management to obtain the best economic and social benefit for the largest number of people, including those to be born in the future.

Wildlife (avifauna)

If what has been said describes the general situation about renewable resources, the picture of wildlife conditions is now clear: it is similar to that of the lands, water, and forests—only showing a higher degree of deterioration.

It is not difficult for people to realize the value of agricultural land, of water for irrigation and energy, or of the industrial use of forests. But this is not the case with wildlife. By strong tradition wild species are thought to belong to whoever can kill them and take advantage of their products. The situation is changing, and (as was once the case in the United States) we are passing now through a period of rapid legal, but rather slow actual, progress.

Of course, present conditions of avifauna are only part of the general situation of wildlife. Migratory waterfowl may be taken as an illustration. As is well

known, not very long ago the Central Plateau was dotted with lakes (large and small) where hundreds of thousands of ducks, geese, and other species used to find wintering refuge and resting waters in their periodical migrations. The picture is greatly changed now. Texcoco Lake, and the other five lakes to the north and east of the beautiful Valley of Mexico, have disappeared for all practical purposes. Not only are they considerably reduced as natural water deposits, but water and habitat are also not the same. Industrial and general pollution prevails, and surrounding towns and opening of lands to agriculture by drainage of natural lakes have completely modified the habitat. The migratory routes still go over the Valley, but the number of birds stopping there is practically nil around Mexico City.

Similar observations can be made about Lake Chapala and, as a matter of fact, about all the lakes in the highlands. We only have to remember the words of Leopold (*Wildlife of Mexico*) in quoting Nordhoff in 1922: "The fresh water marshes of Lake Chapala . . . form another haven for waterfowl. . . . The far interior of this swampy paradise . . . is a vast sanctuary for wildfowl. . . . I saw as many geese, White fronted and Snow, as I have ever seen in the Sacramento Valley, and the number of ducks was past belief, with some interesting species, like the Masked and Florida Black . . . to lend variety." Today, the waters of the lake, with the broad fluctuations of levels produced by heavy utilization, are constantly pumped for irrigation of land, used for the production of electricity, or as a summer resort for rapidly growing industrial Guadalajara, already with more than a million inhabitants.

Water plants on which the birds used to feed have been greatly reduced by the fluctuations of levels produced by pumping and drainage. Industrial pollution and contamination by the increasing use of chemicals for agriculture in the surrounding land and the invasion of hyacinth and water lilies have also done their work.

And in the region where Tecocomulco Lake, Apan Lake, and other small lagoons formed large wintering areas for waterfowl, the greatly important "industrial combine" of Ciudad Sahagún has been developed, with four huge different factories and an entirely new population emerging in the middle of the production center. Naturally Apan Lake is now a mere seasonal pool, and Tecocomulco and the others have been greatly changed as waterfowl habitat.

Along the Gulf coast, the transformation of the great Laguna de Tamiahua, extending from Tampico almost to Tuxpan, is also well known. In this case, massive pollution subsequent to the development of Tampico as a great oil center, has reached, at times, to the almost complete covering of the Laguna with a film of oil. "Hundreds of thousands of dead ducks" were reported once by J. L. Friedman of Texas by the oil contamination. And, although this situation is not so serious today, the progress of the area is based in the oil industry, developing now in Mexico at a rapid pace, and oil pollution of the Laguna is permanent and the danger of its accidental increase is a potential menace.

Considering other migratory birds, perhaps the species which has been most punished is the whitewing dove in northeastern Mexico along the border. The destruction of the brush cover, particularly "ébano," "mezquite," and other thorny species where the whitewing doves used to nest from April to August every year, has caused an unfortunate decrease in its concentrations. Opening of new lands for agriculture (i.e., the extensive use of the bulldozer) and disregard of wildlife were the prime causes. But one more unfortunate thing has to be added. A "cotton boom" prevails now in Tamaulipas, over the large coastal plains extending from Soto la Marina down to Tampico. Hundreds of thousands of acres of brushland are being opened for cotton growing. Along the road from El Mante to Tampico more than 20 new cotton gins can be counted now; and, of course, several posts for pest control by airplane spraying are in active business. The effect of pesticides on the white-winged doves, mourning doves, several species of quail, and even wild turkey, is already quite apparent. Even hawks are disappearing from the area.

A similar situation is contemplated over the Yucatan peninsula, where an accelerated (and, no doubt, strongly needed) plan for diversification of agriculture is now under way. Forest cover and brush, considered of no commercial value, are cleared by machines and fire, to plant corn and beans, in an attempt to have Yucatan produce other things than "henequen." The peninsula, as is well known, has been notable for its diversified avifauna, especially song birds, the ocellated turkey, and a large variety of wild "faisanes" and quail (*Penelope purpurascens*, *Crax rubra*, *Tinamus major*, *Oreophasis derbianus*, and *Colinus nigrogularis*). These, along with deer, javelina, and doves will

greatly suffer since the opening of the land is being done without consideration of wild species.

Finally, a very important program of developing the coasts, both the Gulf and the Pacific, is under way now as part of official programs. Several ports will be opened or enlarged to improve the fishing industry, commercial movement, and the benefits of tourism. All this is important for the country, but we will have to see that the development of coastal cities and contamination of marshes by industrial wastes do not result in a new attack to the migratory waterfowl. The extended marsh regions along both coasts, up to now considered among the best wintering grounds, will be transformed by draining, or polluted and changed in different ways.

Present-Day Situation and Perspectives

In brief, the present situation in Mexico in regard to avifauna and wildlife in general can be summed up by saying that the dynamics of a very rapidly growing population, together with industrial development and technicalization of agricultural practices and, in addition, the opening of new lands for agriculture and the intense development of the road system, have certainly imposed great and profound modifications of the habitat all over the country. The average yield in agricultural production, for instance, is growing at a rate of 4 percent per year, and land which used to be destined for corn or covered with brush is now used for intensive cultivation of wheat, sorghum, or cotton. This means a continuous increase in the application of chemicals, and systematic and highly efficient destruction of natural habitat. The rural population is also increasing rapidly, at a rate of a million more persons per year, and this explains the increased pressure on the available land and the need of new land for agricultural development.

Judging by all this, one might think that conditions and prospects for the future of Mexican avifauna look really sad. And, as a matter of fact, right now they are perhaps in the lowest point of the curve. However, as I said before, the general trend is positive. Economic development of the country and industrialization and technicalization of agriculture mean active progress for Mexicans and a rising level of living. The cultural and social level in general is also on the rise. People are becoming more aware every day of the value of natural resources and, since the number of illiterates is decreas-

ing, the diffusion of official regulations and the indoctrination of people in the country becomes easier. On the other hand, at the high levels of public administration, government officials are now people with university degrees, technically qualified for their jobs.

Consequently, in connection with the protection of avifauna, we would like to present briefly now a few cases which we believe justify our opinion of a generally positive outlook.

Since 1963, in response to the propositions of the Audubon Society of the United States and in accordance with the international agreement for the protection of migratory birds, Isla Rasa in the Gulf of California was declared a nesting refuge for the Heermann gull and the elegant tern (*Larus heermanni* and *Thalasseus elegans*). A house has been built on the island for two special wardens with a boat, especially appointed to stop the stealing of the eggs that was traditional every spring. For a second year the refuge has been protected, this time from March 15 to August 31, and a special budget has been allocated to complete the installations for the wardens, one of which is a biologist, to study the habits of the birds. The money for the operation of the refuge, as has been said, is raised as a fine example of collaboration between the Mexican government and the Audubon Society of Washington. A movie film about the island has also been prepared and is continuously used for educational purposes in schools, scientific institutions, and television.

A second and, from our point of view, very important project, is the work now under way at the small lake of Atenco, close to Mexico City. This is an official project, in the future development of which we hope to find help from Ducks Unlimited or other institutions. Atenco is practically all that remains of the old and very large Texcoco Lake. As has been explained already, the lakes of the Valley of Mexico were among the best wintering places for migratory waterfowl coming through the Central and Mississippi flyways. Drainage of the lakes, a couple of generations ago, entirely changed the picture. Since last year, however, a special line of our official budget is used by a group of one biologist and two wardens for the study and protection of Atenco and two other smaller lakes in the area. Our biologist already has presented a technical report with recommendations for the restoration of the habitat, in order to have the lake officially declared a wintering

refuge by the president of the republic. This report is available for consultation.

As a third example of protection of the avifauna we are pleased to refer here to a project developing in the main nesting zone of the white-winged dove, in northeastern Tamaulipas from Matamoros and Reynosa down to El Mante and Victoria. The special type of vegetation of this area makes it highly adequate for the reproduction of the doves, a valuable game species. The clearing of the brush in opening lands for cultivation in the Río Grande Valley, on the other side of the border, has so deteriorated the nesting grounds of the dove that populations were brought to critical conditions and the hunting season was closed in Texas. Since last year, with money raised by the Mexican government in collaboration with the Wildlife Management Institute of Washington, a special patrol and one biologist were sent to cover the area from May to August (i.e., during the nesting season). In this connection, it is very important to say that this area was heavily visited by American hunters at the invitation of Mexican ranchers, since the latter consider the dove as a predator of sorghum fields. Consequently, it is not an easy job and, since the area is also under heavy pressure as a result of the cotton and sorghum booms, we will eventually have to resort to the buying of special tracts of land in which clearing of the brush will be prohibited. This is, perhaps, the only solution for the problems of habitat preservation in cases like this.

And finally, beginning this year, a special committee has been appointed in the state of Sonora, for the administration and protection of the Wildlife Refuge of Tiburón Island, also in the Gulf of California. Tiburón is the largest island of the country, with an area of 1,200 square kilometers of desert land. Since water is very scarce, the island cannot be used for agriculture or cattle raising. On the other hand, it is a natural refuge for mule deer and other species. White-winged dove, mourning dove, Gambel's quail, and a great variety of song birds are among the avifauna of the island. It is also a wintering place for several species of ducks. Since the area was practically considered as no man's land, hunters and the Seri Indians used to raid the mountains and valleys after deer and game birds with nobody to stop them. Now the protection of the island is enforced by two wardens, a special road for patrolling and houses for the wardens will soon be built, and a biologist has been appointed to take care of the habitat preservation of the island. Consequently, protection and preservation will soon be more effective.

Incidentally, the island is so important from the point of view of ecology that the University of Arizona has already expressed desire to participate in the studies and protection of Tiburón.

These examples, and the ample diffusion of technical information and regulations that is now under way—reaching parts of the country that were practically abandoned before—make us believe that, as we said, we are now in the turning point of the curve.

Our main problems are the establishment of more wildlife refuges, wintering areas, and wilderness zones for the reproduction of wildlife in general and, particularly, migratory and resident avifauna, in which the territory of Mexico is so rich. That is, rich in the variety of species, although several of them are in critical condition due to some negative aspects of the development of the country. In order to reconcile conflicting interests we will have to start a strong educational campaign directed to the general population, and make our farmers aware of the economic and cultural value of wildlife and the preservation of habitat as routine cultural practice. With the help of some outside institutions for a start we sincerely hope to find the way and means to succeed.

A few final words of explanation. The present report is intended as a broad and panoramic view of the status of avifauna in Mexico. It does not follow the usual presentation by the specialist, who would probably concentrate on purely ornithological considerations. A broader view has been preferred to make room for sociological and economic information, very important since the background is the development of Mexico in our day. After all, if living things constitute the most important part of man's environment, human populations and cities and all kinds of works of science and technology form the most effective and influential area of the environment of wildlife. It is our duty to see that their effect is positive.

Discussion

EISENMANN. To what extent are the refuges and parks that have been set up being protected now?

HERNÁNDEZ CORZO. Right now the ones I mentioned are actually protected, all of them, even the last one, with roads and house ready for use for about three months. All of them are patrolled, and in this connection, strange as it may seem to you, I myself (in spite of

my high position there, as a high official of my government) personally do patrolling work rather frequently with my helicopter and airplane. As some people say down there, I am becoming a law enforcement expert and I know how to use firearms! This is necessary. So our refuges are actually protected. We are sure of that. And I am not speaking of the pure declaration on paper. They are refuges in actual operation.

CLEMENT. I am sure we are all very impressed and thankful to Hernández Corzo for the broad perspective he has given us on the Mexican situation. I would like you to clarify one thing that I may have misunderstood, which seems to me to have a high potential here. You suggested at one point that perhaps we need to skip the "second stage" and go right to scientific management which would imply governmental imposition. Do you mean by that second stage the education of the public?

HERNÁNDEZ CORZO. What I mean is this. And I consider the question very important. As I previously explained here, these phases in the evolution of the conservation movement are from wanton destruction, to the exhaustive use, to the romantic conservation movement, to scientific management of the resources. Since we are now coming into the romantic movement, I would like to see that this step is skipped and go right down to scientific management, because scientific and technical management will really produce economic values for our people. And this is the best way to convince them that things have to be protected. It is rather useless (especially in countries like Mexico) to expect that everyone will understand that wildlife in general has to be preserved because they represent moral or social values. They want to see more concrete things, you know.

Avifauna in Mexico

Allan Phillips

After the introduction by Hernández Corzo, I do not think I need to say much about Mexico; you know about it now. Perhaps I might elaborate on the last point he was making and say that it is perfectly right that Mexicans are very practical people. They are interested in things that are practical and in which they can see a value. This is the way to appeal to them. They love beauty, birds and flowers, but the practical aspect is the one that is actually going to conserve the habitats. Also I might say, right now, that I know a great deal less than Hernández Corzo about north-eastern Mexico (Tamaulipas, etc.); therefore, I will not attempt to speak about it. My experience has been mostly in the western and southern parts of the country, and it is quite a large country.

On a map of Mexico all the Central American countries get shoved into one corner. So we have an area which is large and correspondingly diverse, because there are areas such as Tiburón Island where the annual average rainfall would probably not exceed about 50 millimeters a year, around the Gulf of California; and there are other areas that would be a wet forest of one sort or another in Holdridge's classification, on which I am not an expert. We have, of course, as you would expect, a very steady gradation; as you go down the west coast from, say, Nogales or San Luis, Río Colorado, to Nayarit, the desert thickens up more and more; first you pass into what is often referred to as "thorn forest." Passing into Nayarit on the west coast, and still going right down the west coast (there are no mountains at all), you come into an area that is actually quite tall forest, passing meanwhile through certain areas of palm *sabana*. This is all diversity at sea level, practically. Needless to say, crossing the high mountain backbone of Mexico you have a great many other environments in an extremely complex country.

Any plans for conservation in Mexico will certainly fail if they do not take this into consideration. Some of these habitats are extremely local, some of them are extremely widespread. Naturally, it is the ones that

are extremely local that we need to think about particularly, and especially if those areas are vulnerable. The vulnerability of an area is, of course, as various speakers have commented, largely a function of slope, because the removal of vegetation on a plain will very seldom have the disastrous effect of the removal on a steep slope. One of the rather bad factors of the present Mexican situation is that there are a number of peoples and tribes that live in the higher mountains, particularly in Oaxaca and Chiapas, that practice farming (this is also true on the east side of the country). They practice farming on slopes that are absolutely unsuitable for agriculture, and the only result of this will be that there will be nothing but bare rocks on these mountains after a while. This is something that it will be very difficult to do anything about, because it is a matter of the culture of these people who have done this for many years; whether the government through education can eventually persuade them that they should move to a more adequate place. I will not venture to predict.

I should also back up Hernández Corzo on his statements about the knowledge of the government. The Mexican Government is and has been for some years concerned about conservation; the government officials are intelligent people. They know what the country is up against, a great deal more than the average farmer does. Unfortunately, the average farmer is the man who has the machete, the ax, and the match. Therefore we have, in Mexico as elsewhere, a great need of education, and the government is very actively interested in educational problems, trying to push education. But that is rather a long-range procedure and I do not anticipate that we can get very far with just plain education, although it should be pushed to the greatest extent; and I certainly would recommend that conservation organizations that have films arrange for them to be available for television shows and meetings of clubs, or anything of that sort. There is a very great need, which has been mentioned today, of books; there

are absolutely no books on birds in Spanish that are helpful to the average Mexican. Here again we cannot get started because nobody can become interested in birds.

In connection with the Olrog book, it was mentioned that the pictures are not of the best. I wonder why it is that conservation organizations interested in educating people cannot supply an artist who can make attractive pictures; because if you want to interest people in birds, through bird books, they should be *attractive* books. That seems to me to be a simple, elementary step that could be taken, which would not be very expensive.

The Yucatan Peninsula was mentioned, and you all know where that is, in the north in the Caribbean (Gulf of Mexico). That happens to be an area where, along with these developments that have been referred to, there is still a great deal of primeval forest. In fact, the surviving more or less primeval forests in Mexico today, of the more or less wet type, are concentrated along the east side of the Yucatan Peninsula, particularly in the northeast of Quintana Roo, and in the jungles of the Río Coatzacoalcos in the extreme southeast of Veracruz, where there are still large areas undeveloped. The story elsewhere is very much as we have heard it from many other speakers; as soon as a road goes in, people move in, and the forest is gone in a few years.

The changes in the populations of small birds ought to be mentioned, since Hernández Corzo has concentrated largely on the big birds. I agree completely with what has been said by the other speakers, that as far as small North American migrants are concerned, we need not worry. In the first place they are more or less adaptable; and in the second place you have to remember the seasonal changes in behavior which have been referred to rather in passing. A bird is not so vulnerable to predators or other enemies on the winter range because it does not have to raise young. It is not tied to a particular place. The vulnerable phase in a bird's life history is always when it has to maintain a territory, to return repeatedly to the same spot to raise young; and, of course, the extreme vulnerability of any species is before it actually gets out of the nest. That is where a very large percentage of birds are lost. So I think we do not need to worry so much about the migrants as we do about the local populations. Now I am fortunate in talking about Mexico because, as a function very largely of the size of the area, we can

boast of a great many endemic species; we do not have to speak of one, two, or three. In the Balsas basin alone, south of Mexico City, in the south-central part of the country, there are several species completely endemic to that one region, and quite distinct species that are practically limited to the northwestern part of Oaxaca and adjacent southwestern Puebla, some of them spilling a little farther over. There are also endemic forms up and down the west coast, which are in some cases species, and in some very well marked races; but at any rate the center is one of marked diversification. The Yucatan Peninsula has a few endemics; the central part of the country generally is not very rich in birds.

There are possibilities of development in Mexico, fortunately, which are not shared by the other countries and which would not damage the fauna too much. I am, of course, referring particularly to irrigation, because Mexico (unlike many of the countries to the south) has a great deal of arid land. This arid land in many cases is flat, level, and rich; it lies at the foot of high mountains which receive adequate rainfall; and the government has developed some very fine projects (I guess it is partly private development). I am referring particularly to the valleys of Sonora and northern Sinaloa. There we have extensive areas that were once desert and that are now very rich and productive farmlands; there has been relatively little damage done to the bird life. It would be nice, I think, when these large valleys are placed in cultivation, to set aside some little areas of desert just as a memento, but it is not really a vital matter. The desert fauna is not particularly local in most cases, and I do not think we should in any way oppose a development that promises to ease the lot of the farming without really serious damage to the avifauna. We should *encourage* the settling of people in such areas if possible. If we could only get the people off the mountains of Oaxaca and into Sinaloa we would be in good shape.

The central part of Mexico in the north is quite arid but it is also quite high. The possibilities on the plateau are definitely less than on these west coast lowland or Gulf of California (that is, Sonora and Sinaloa) areas.

Farming in Mexico is a very ancient occupation. Mexico is another of the countries that was occupied by a numerous population long before Columbus. It is my opinion that originally the Yucatan Peninsula was almost all rain forest to within a few miles of the coast, and the Mayan system of milpa agriculture has

had a devastating effect on this forest over the centuries. As you all know, there are a great many ruins, particularly in northern Yucatan; the Mayas have certainly been there for a long time, because it was the center of their empire. I think that probably, when they moved in, there was a great deal more soil on that limestone than there is now. This is based in part on ornithological evidence from work that we are currently doing in that area; certainly it is unexpected, if it was not originally rain forest, to find certain rain forest birds occurring well out toward northern Yucatan, such for example as the little spotted-breasted wren (*Thryothorus maculipectus*). There is a certain amount of evidence that rain forest receded long before the present-day farming began, or shall we say increased. The centers of Indian population otherwise were always on the main part of the plateau around the present Mexico City and westward, and down through Oaxaca (which has been referred to already as being a potential desert).

Some of the worst examples of erosion that you can find anywhere in the world are in northwestern Oaxaca around Nochixtlan—perfectly horrible places. You can find others in Nayarit and other areas, but they are quite local there. Whether desertization is going to continue or not I would hardly be in a position to know; it is dependent on so many factors. It is a possibility, and I have hopes that it will be stopped. Remember that there is a tremendous variation in altitude all through that country. High mountains are universal in southern Mexico, and if farmers can be kept off the tops of them I do not think we will have only a big desert in Oaxaca.

The effect of hunting on the white-winged dove (*Zenaida asiatica*) might be mentioned. My experience is that most Mexican hunters are, like many hunters elsewhere, concerned chiefly with the larger birds. Only the rather wealthy people can afford to go out and shoot doves. One factor that has helped to conserve doves in Mexico, and other birds also, is that guns are not common. The army will frequently take them away from people if they catch them with unauthorized guns, and relatively very few Mexicans can afford to do much shooting; so what they go after primarily are deer, turkey, and *Crax*, as in other countries. The pressure on doves is not a very important factor in Mexico.

Ducks have been hunted very heavily, but a great deal of the problem is that American hunters go down

to Mexico and act with complete disregard of laws, customs, and everything else. Discouraging these hunters would certainly help a great deal toward conservation in Mexico. Tales of their deeds are perfectly horrendous, deeds which are of no possible benefit to themselves except for the enjoyment of slaughter. That is more or less an international problem and we should look into ways of eliminating this practice.

Perhaps we should mention, before closing, that besides the physical changes in the country, to which we have been referring, and the chemical changes which certainly are disastrous (I am thinking particularly of the valleys of Sonora and Sinaloa, which are very heavily sprayed; I do not know anything about Tamaulipas), there is also one other physical change: that is in the composition of the actual fauna itself. As elsewhere in the world we have groups that are extending and groups that are receding. I think that while it is a very good thing to have refuges for Heermann's gulls (*Larus heermanni*), experience with gulls in other countries would dictate that we should not let them get out of hand because they can eat the terns out. Similarly a great increase in cowbirds would be highly undesirable for certain species, as has occurred. We do not have any data in Mexico, but in Arizona, I think it is fairly certain that some of the species we have seen drop out locally have simply disappeared due to cowbird parasitism. So we have to bear in mind not only the physical environment of plants and soil, which certainly are of primary importance, but also *biological* changes which could have a disastrous effect on certain species in certain areas.

Mexico is too big a country to pinpoint particular areas for particular species. As to the distribution of North American migrants, since I published a paper on that in the *Revista de la Sociedad Mexicana de Historia Natural* a few years ago, I will refer any one interested to that. As all of you know, I think, and as has been mentioned, the western migrants have a tendency to come down in the high pine country. The eastern migrants generally come down the east coast, but even in Mexico a good many eastern species do winter on the west coast. In fact, interestingly enough, if you want to see eastern warblers in western Mexico, the thing to do is to go as far west as you can and get out into the mangroves on the coast. There you will see plenty of American redstarts

(*Setophaga ruticilla*), black-and-white warblers (*Mniotilta varia*), northern waterthrushes (*Seiurus noveboracensis*), and so forth.

Discussion

IBARRA. I am not sure whether you said something about the crested guan, which is an important bird, considered by many ornithologists as one of the most interesting continental birds. Unfortunately, this bird—horned guan—is scarce in Guatemala, as well as some other important species. Certainly I know that the horned guan and his relatives are not common in the Central American region. The existence of any law to protect this bird against hunting is unknown to me. A few years ago I saw a report of the American Museum of Natural History and the Natural History Society of Buffalo. The report describes the results of a trip to Guatemala and Chiapas of Mexico for a survey on the population of this bird. I believe that within the shortest time in the future we should recommend protection for this bird by proper authorities. I would like to know if Mexico is taking care of this matter.

HERNÁNDEZ CORZO. I think I can answer that question. Of course, the use of regional names is usually confusing. In this case, for instance, I do not know whether you are referring to the crested guan or to the horned guan.

IBARRA. The horned guan.

HERNÁNDEZ CORZO. In fact we have in mind setting up a refuge for the horned guan in Chiapas. Perhaps this will be possible next year because the bird is in a very critical situation, at least in Mexico. As far as we know there is only one place—not a very large place—where one can find the horned guan, and we are taking that into consideration.

VOGT. These seem to be particularly important papers because this is a sort of projection of things to come in much of the area that we are concerned with. Mexico now has 60 people per square mile. By the end of the century it will have 180 people per square mile at the current rate of increase. It is doubling in about 21 years, whereas Costa Rica is doubling in about 17 years. The pressure on the environment is going to accelerate, unless somehow there can be a change in point of view. And erosion is so violent over so much of Mexico that it just does not leave a habitat. You will see some very similar country in Dr. Lehmann's slides. The land is turned into a sterile desert over very large areas which, it seems to me, cannot help

affecting the migratory birds from the United States.

Dr. Wetmore's report on the slingshot is dismaying and to say that those slingshots do not move northward very quickly might be challengeable. It is a good, cheap industry, and within 10 years I would expect to see them fairly common in Mexico, which brings us to the importance of "sentimentalist things" as Dr. Hernández calls them.

I think there is a tremendous need for education of the masses. This could be done successfully, I believe, for two reasons: governments are anxious to get reading material out to the people. Schools that are not well provided with books would almost certainly welcome material on conservation and on birds simply as part of literacy campaigns. Also, the printing of such books is very cheap in Mexico, and it would be very easy, and take relatively few dollars, to provide millions of books of various kinds on conservation of birds and other resources.

The Conservation Foundation is experimenting with comic books for campesinos. We chose the comic book format because it is the one kind of book that campesinos read. And for \$65,000 we have been able to get three comic books, one on soil conservation, one on wildlife, and one on the value of forests, each in an edition of 20,000 copies. This is just an initial experiment that caught the imagination of somebody down there—a Mexican who has doubled the print order. We could not do anything like that here in the United States. They are horrible to look at, but they are the kind of thing the peasants read and like and use, and I think we could communicate with them through this medium.

I do not think we should feel comfortable because there is still so much undeveloped land in Mexico. Because of this rising rate of population pressure and the literal destruction of the habitat, you do get real areas of desert in Central America as you do over much of the central plateau of Mexico.

PHILLIPS. It is quite true, certainly, but there are two things: In the first place a comic book is not by any means limited to the country people; it is almost the only thing a lot of people in the cities read, too.

But I think that it is a very bad mistake to be alarmed about slingshots or any small weapon. Slingshots are in Mexico. They have been in Mexico for many years, and they have done no obvious damage to the bird population; and I do not think they will ever do any damage to the bird population, as long as

the habitat is there. We must very carefully distinguish between attempting to conserve *areas* and *species*, which we want to do, and attempting to conserve *individuals*, which is utterly impossible because the average bird does not live more than 2 years anyway (it is a very old small bird that lives 4 or 5 years). As long as there is an adequate vegetational substrate for birds to nest in, we do not need to worry about sling-shots, I am sure of that.

SHORT. If I may be permitted to comment here, it seems appropriate to note that we have a great responsibility in Latin America to avoid overemphasis on the saving of *individual* species, which may be economically possible in North America, but not elsewhere. I think such emphasis is completely unjustified in terms of the great number of species occurring there, and the tremendous changes in habitat that are bound to take place in Latin America. In preparing the literature and programs that will be put on television, we should stress the habitats and the ecology of all living things. We should not dwell so much on saving individual species, because one can take a species out of its habitat and raise it in a vacuum in a zoo, thus preserving the species, but only as tiny populations which are completely irrelevant to nature. I doubt that we can afford spending millions of dollars on individual species, as we may be doing in this country. We must save the greatest number of species and can best do this by saving appropriate portions of various habitats.

PHILLIPS. I would just say that surely Dr. Short does not mean to imply that we should not stress certain individual species, like the quetzal, that will appeal to national pride.

SHORT. This would be of little value if we cannot relate ecology and habitat to saving the species.

PETERSON. Is it not wrong to stress the North American migrants, which are more flexible anyway? The ones that really are going to be in trouble are the endemics, the resident species, particularly of climax environments that have evolved over long periods of time and that are not successional environments. I think the birds that live in such environments are the birds that are in trouble.

FOSBERG. I have one comment on these last remarks about the preservation of individual species. We must, of course, preserve the habitat to preserve an individual species. I think it is not at all bad to emphasize the preservation of individual species since if you pre-

serve a habitat which will enable you to maintain an individual species you will automatically protect a great array of other species that also use that habitat. The habitats are not divided up one by one, with one bird to a habitat. That is not the way it works. Use the whooping crane or any other conspicuous species as a focal point, and you will take care of quite a few other species that might not have the same publicity value in themselves.

PHILLIPS. I think that we would all agree on that.

EISENMANN. I was very much interested in what Dr. Hernández Corzo said about what is being done in Mexico. There is no doubt that in Mexico, as elsewhere, there are a great many people on a subsistence level. Nevertheless, I think the emotional, the so-called "romantic," aspects are very important. I know little about Mexico beyond having visited there a couple of times. But surely Mexicans are as "romantic" as any people. I suggest that one way to get action is through appeal to emotions, through what some call romantic or sentimental considerations. Any group of people who could have as much fine popular art today as the Mexicans, even in the lowliest places, must have a strong aesthetic and romantic feeling. I know that in the United States the conservation movement began as a "romantic" movement. It was not an economic movement. But the leaders were romantics, if you wish, who understood human nature. And you can always point out that the things which appeal to people in a romantic or sentimental or aesthetic sense are also important to the complete human being, even in a material sense. We should not, I feel, in Latin America or anywhere else, overlook the aesthetic, emotional, and sentimental aspects of conservation. I think they have appeal, too. Of course one cannot forget the economic aspects.

HERNÁNDEZ CORZO. I want to insist on my points of view, because I should know Mexico better than you do, Dr. Eisenmann. I do not mean that we are supposed to overlook this romantic aspect and the effect it produces, but I merely say that you here in the United States are in the position now to change your conservation movement from the romantic to a more practical way of expressing it. You know how schools of thought also change everyday. But this is your own concern. In regard to Mexico, what I mean is this. In Mexico (and this is why I began my paper with a panoramic view of the economic development

of the country) our main concern is our economic development with employment for everybody. We have lots of people practically not making a living. So we have to say that this is more urgent than anything else. This does not mean that there is no room for romantic expressions, or romantic thoughts and everything else, but they will have to come after the satisfaction of more urgent needs. So this is why I am very sure that if we go to our people and tell them that they are supposed to preserve wildlife because of the aesthetic value they will understand, they will even shout "Ole," but will not find themselves able to act accordingly. And since they must eat, they will continue to kill birds for eating. That is quite true.

And this is the only thing I want to express in my paper when I say that we must emphasize the practical aspects in preference to the aesthetic aspects in dealing with the wildlife resources. Land, water, forests, and wildlife are four entities of the same unit and this unit is the natural renewable resource. They have a meaning taken together: an economic meaning for people, and an aesthetic value, of course, and a social value also. But remember that in Mexico now, according to the actual trends of our economic and social progress, whether we like it or not (and without this regard of other values) we have to concentrate on the economic values of these four entities constituting our natural and physical background.

Avifauna in Venezuela

William H. Phelps, Jr.

I have prepared only four pages of notes, but I knew that by the time my turn came, all of you excellent professionals gathered here would have covered all the aspects of conservation which are the object of this meeting. An amateur like me has very little to add. All the problems discussed here, from different countries, exist also in Venezuela. Venezuela has recently been cataloged as a semideveloped country, and the speed with which we are developing aggravates all the conservation problems in Latin America, as William Vogt pointed out some years ago. They are now even more serious because more roads are being constructed to more remote areas. And we all know that civilization and really unspoiled nature are incompatible.

Somebody once said that a squirrel could go from the Atlantic Ocean to the Mississippi River without touching the ground. You can say today that a monkey can almost go from Venezuela to Argentina, after swimming a couple of streams like the Amazon and the Orinoco, without touching the ground. I wonder how long he will be able to do that. Man's influence on the environment in developed countries is frightening. Some of you may remember a meeting in Belgium of the UIPN some years ago. The burgermeister of Brussels stated that there is not one square meter of Belgium that has not been affected by man. When that happens conservationists are restricted to conserving Fosberg's type of habitat: one square kilometer, or a few square kilometers, not because preserving such small areas is a good idea but because that is all that is left to preserve! In South America there are still large areas that can be set aside and something is being done about it. It is important that in South America large areas be set aside as reserves very soon, while they are still considered wilderness. In England there is a Society for the Preservation of the Landscape. It is wonderful, but it also frightens one to think of the eventual establishment of such a type of society in

Venezuela where now our whole nation is "landscape."

William Vogt mentioned that the protection of watersheds may not be keeping pace with the corresponding legislation. In Venezuela this is true, but there is some progress and strict measures are being taken to enforce recently enacted hunting and conservation laws. It is evident that only with continuing education will there be marked progress in getting as many of our people as possible to grasp the concept of conservation. The sooner the better, because there is still time to preserve a lot.

In Venezuela it is forbidden to keep native birds in cages, not even parrots; however, it is practically impossible to keep people from having parrots in their patios or backyards. When the turpial was made the national bird many people wanted one, but as far as we know the turpial fortunately seems to be surviving this dangerous notoriety. A branch of the army, called the national guard, has the responsibility for enforcing the conservation laws.

The Sociedad Venezolana de Ciencias Naturales has been the pioneer in nature protection and the preservation of natural habitats, and for the last 20 years has been very active. The Department of Agriculture has an important section on conservation of natural resources which is always headed by very capable and well-trained conservationists. Every year there are many conferences and other meetings which the press, radio, and television stations, with their national networks, cover adequately. Some years ago the International Union for the Protection of Nature met in Caracas and for a week all Venezuela seemed to be talking about the protection of nature. Many thought that with the departure of the delegates the interest would disappear, but it did not. Fortunately, what Vogt said at that meeting and what he had written in his book *Road to Survival* shocked many people in Latin America into realizing the importance of conservation. The Venezuelan section of the Interna-

tional Council for Bird Preservation also has been active in bird protection. Further international cooperation in bird protection seems worthwhile and perhaps a resolution could be prepared to recommend it. We all know that the United States sets the example by not permitting the importation of birds which are not allowed to be exported by the country of origin.

Industrial pollution has been mentioned, especially by Hernández Corzo, and we in Venezuela are beginning to have our share of it because of the increasing industrialization. In the Lake Maracaibo region oil is often spilled accidentally and birds suffer. Although the oil companies responsible are often fined, the pollution of the waters of the lake and of its beaches continues to some extent.

Just one word about fires. In remote areas Indians have always signaled their location to their friends by setting vegetation on fire. Now, with matches easily available, it is much easier for them to make fires, and of course many savanna fires yearly consume at least the fringes of even the most humid of forests. In the llanos, the cattle-raising area of Venezuela, the savannas are periodically set on fire. The Sociedad Venezolana de Ciencias Naturales maintains a biological research station in the llanos, and one of its objects is to find out why the savannas are burned every year. The reason remains undetermined after several years of experiments. It is still a controversial matter.

As far as bird protection is concerned, may I say that we are not following the example set by some very industrialized nations with old civilizations where the people are legally permitted to net little songbirds for food and to kill them for sport.

Discussion

VOGT. It seems to me that Venezuela does a really outstanding job on its national parks, setting up some good areas and effectively protecting them. I wonder if you would give us some idea of the genesis of the park notion there, and the influence that Pittier might have had? This is almost an exception in the Latin culture. That there is this appreciation of these natural areas seems to me an encouraging example of the fact that people can be educated. Am I right in that?

PHELPS. Yes, Dr. Vogt. Dr. Henri Pittier did a lot for conservation in Venezuela. He was very frank and open in his constructive criticism everytime he thought nature was being abused. He was an outstanding botanist, as you know, and his remarkable personality and outspoken manner made an impact on every community where he worked. His influence was felt in Costa Rica, for example, and in other nations of Central America. His approach was merciless you might say; it almost had that "Vogt" quality.

I understand that the government of the United States will not permit the importation of birds if they are protected in the countries from which they are sent.

IBARRA. I do not intend to ask something, but to suggest that we should keep silent for a few seconds in honor of the best ornithologist in Venezuela—the late Dr. William Phelps. In Venezuela there is a famous collection of birds which is known as the Colección Ornitológica Phelps. This valuable work is all due to your father and you, who helped him. Only a few days ago I learned of his death. Therefore, I would like to suggest in this meeting that we keep silent in recognition of his life's work as an ornithologist.

Effects of the Environmental Changes on the Avifauna of the Republic of Colombia

Antonio Olivares, O.F.M.

Historical Perspective

In the republic of Colombia, which occupies an area of 113,855,500 hectares in the extreme north-western part of South America, the avifauna has been classified into 20 orders, 88 families, 678 genera, 1,570 species, and 2,675 subspecies. Of these 200 species are migratory the greater part of which are winter residents and come from North America. From the austral hemisphere the summer residents number only five species, the most recent of which, *Sublegatus modestus*, was registered in 1964.

Colombia is probably the world's richest country in bird life. Her extraordinary richness, among other factors, may be explained by considering that this is the only South American country bathed by two oceans, the Atlantic to the north, and the Pacific to the west; the presence of the three Andean ranges that cross from south to north, locking in the river beds of the Cauca and Magdalena; the vast llanos in the eastern region; and the dense jungles of the Orinocan and Amazonian regions. Such a varied topography divides this tropical country into four life zones: the tropical or hot, the subtropical or temperate, the cold, and the extreme desolate and frigid. There are five faunal areas: the Colombian-Pacific; the Cauca and Magdalena, including the humid and arid regions; the Caribbean; and the Amazonian.

Forests occupy 63,335,500 hectares or 55 percent of Colombia; the river, lake, and swamp areas cover 10 million hectares or 8 percent; and cultivated areas occupy only 2,733,800 hectares or 2.4 percent. The principal crops of 1965 in hectares were: corn, 831,500; coffee, 810,000; sugar cane, 427,000; rice, 331,700; cotton, 164,000; sesame, 130,000; wheat 106,000; potatoes, 64,000; and bananas, 26,000. Of a population of 17 million about half are engaged in agriculture.

For information on the first species of Colombian birds found in scientific literature we turn to Linnaeus who described in his *Systema Naturae* (10th edition, 1758) a small parrot (*Aratinga pertinax aeruginosus*) whose habitat according to modern authors is Calamar on the lower Magdalena River, Colombia. In the 12th edition (1776) Linnaeus includes a tree duck (*Dendrocygna autumnalis*), originally of Colombia, according to Brabourne and Chubb; and the chavarría (*Chauna chavaria*), according to material sent from Cartagena by Nicolás José Jacquin. Continuation and study of classifying Colombian bird life was carried on by Müller (1776), Jacquin (1784), Gmelin (1789), Humboldt (1805), and Bechstein (1811). In 1828 Lesson dedicated a sickle-winged guan (*Chamaepetes goudotii*) to Justin Goudot on material he had collected in Quindío (Central Andes) in 1827. It is believed that during his stay in Colombia Goudot taught the natives how to prepare bird skins. They sent these by the thousands to Europe, where they were used for feminine adornment. Only a few reached scientific hands. The commerce in feathers continued well into our century. These skins were simply labeled "Bogota" with no further reference to exact location of capture. From approximately the middle of the past century, no less than 270 descriptions of new species were made by Sclater, Lafresnaye, Berlepsch, and others.

Delattre and Bourcier (1846) were the pioneers in locating Colombian bird life. Their classifications were based upon material collected by Delattre on his expedition from Buenaventura to Pasto in 1846, in which he passed through Cali and Popayán.

The nation was visited in the 20th century by Chapman, Carriker, Wetmore, von Sneider, Miller and others, all of whom have published pertinent avian studies. De Schauensee has reviewed all known infor-

mation on bird life up to the past year in his book *The Birds of Colombia*. Additions to the work of Schauensee are being published by Nicéforo María and Olivares of the Museum of the Instituto de La Salle Bogotá, and of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia.

Among the families that have the largest number of species in Colombia are the following: Trochilidae with 134, Formicariidae with 155, Thraupidae with 120, and Fringillidae with 77.

It is necessary to add to the above material the truly insular birds, such as those of the San Andrés and Providencia archipelago in the Atlantic. It was possible for Bond in 1950 to study its wildlife and 54 species and subspecies were observed. Therefore the bird life of the archipelago should be added to the birds recognized in Colombian territory—but the species of San Andrés and Providencia are in closer affinity to the bird life of the West Indies than to the northwest of South America. The avifauna of the Gorgona and Malpelo islands in the Pacific have been classified with the continental.

Among the largest birds in Colombia we find the condor (*Vultur gryphus*) for its volume, and the jabiru (*Jabiru mycteria*) for its height; the smallest are certain hummingbirds (Trochilidae) and a short-tailed pygmy tyrant (*Myiornis ecaudatus miserabilis*).

Our birds have not been used for truly productive and economic means. Since time immemorial the natives have kept captured birds (Ramphastidae, Cracidae, Psophiidae, Psittacidae, Icteridae, and other families) to ornament their homes. This custom has been kept alive to the present day; however, these species have not been domesticated for profit.

In Colombia the existing species are known by their names, not by how they live; in other words, work has been done in taxonomy, but to date very few ecological studies have been completed.

Since the beginning of the present century, particularly in the past 30 years, the density of bird populations, locality or habitat and even feeding habits have been changed. These changes have been due largely to man-made transformations of the habitat for economic gain. Man has destroyed great areas of forests, established grazing lands, drained lakes and swamps, channeled small rivers, set fires, built dams, opened highways, and polluted the waters with industrial wastes. Other ecological changes have been wrought by the increased use of fungicides, herbicides,

and insecticides in man's fight against threats to his crops of sugar cane, cotton, rice, potatoes, tobacco, bananas, etc. Reforestation has been recognized as essential, and work is going on with species not native to Colombia, such as *Pinus* and *Eucalyptus*.

Specific Effects on Avian Populations Due to Environmental Changes Created by Human Activity

With the destruction of forests, birds immediately suffer the loss of nests with eggs or chicks and must emigrate to another forest zone. In the new area tree birds as well as land birds encounter many difficulties before adapting to the new habitat, interrupting in this manner for extended periods of time functions of vital cycles such as reproduction. Furthermore, the avian community has been revealed and is more easily hunted by man and by its natural predators.

Lately in Colombia the forests of the higher altitudes of the Andes have been destroyed for the cultivation of potatoes, wheat, and barley. The condor (*Vultur gryphus*) has been one of the species most affected by the environmental changes of these zones. In my monograph on this bird published in 1963 I noted:

The 3d of January 1963 the author visited the town of Chita (Boyacá), with the intention of observing the high peaks of the eastern Andes near the Sierra Nevada of Chita or Cocuy, where old natives informed him that up to 30 or 40 years ago you could frequently see pairs of condors, who descended from their high haunts approaching sheep corrals, occasionally finding an abandoned and new born lamb on which they slaked their hunger. In this region the condor is known only by the name *buitre*, and an old resident tells the story of the capture of a condor around 1925. Luring him with the carcass of a small sheep, he took the bird to the town and a leading citizen had the condor sent to Bogotá where the bird was probably mounted for exhibition in the National Museum. Others told that around the same time it was customary to exhibit *buitres* on the arch over altars in the processions of Corpus Christi. Lastly, a hunter, who was an authority on the avifauna of the region, told us that a year ago he had seen a *buitre* flying over a path between the town of Chita and the Sierra Nevada. He stated that he did not follow the bird and, further, that the few birds seen in recent years were very shy.

The sites formerly inhabited by the condors in that region of the Andes are now too heavily populated and farmed, so that they cannot find food; their niche has been transformed by the human element, and this must be the reason for their evacuation. It is likely that in the vicinity of the Sierra Nevada there still exist some condors, far from human presence and where the bird has liberty to seek his prey over large areas.

Today it is safe to say that there are more condors in cages than on the peaks of our Andes.

If this has happened to the condor, which needs an immense area for its distribution, what will happen to communities of tree birds and land birds that have their habitats circumscribed? Many of these species, having changed their original homes, roam the vicinity and are easy victims to their enemies, or conform to a precarious existence without fulfilling several functions of their vital cycle, resulting in decimation almost to the point of extinction. This has been observed in Formicariidae with the species *Grallaria quitensis* and in Thraupidae with *Compsocoma flavinucha*, *Buthraupis eximia*, and *Dubusia taeniata*.

In the subtropical zones, especially in the Central Andes, the forests have been converted into coffee plantations or grazing lands, the result being the extinction, in these areas at least, of some species of land life. In 1915 Chapman found *Nothocercus bonapartei* without difficulty in the high subtropical zone, in the well known area of La Aguadita about 15 kilometers to the northwest of the Bogotá savanna. In recent years this area has been intensely explored and not a single specimen has been found.

In the cultivated areas of these regions a few species adapt themselves to the new environment. In the Quindío region, which is highly cultivated with coffee, it is not unusual to find *Crypturellus soui*, species of Thraupidae such as *Tachyphonus rufus* and *Ramphocelus dimidiatus*, and several species of *Synallaxis*.

Some areas of tropical cisandine jungle have been colonized. Because of the clearing of trees and undergrowth in the entire vicinity, populations of the Cracidae, Psophiidae, Tinamidae, and Passeriformes have been decimated.

In the draining of lakes and swamplands and channeling of rivers, damage of the following nature has arisen: In 1963 a small lake was drained in the Bogotá savanna, leaving nests with chicks of *Podilymbus podiceps*. The chicks were captured when the rushes were pulled up, and one chick was brought to the bird division (ICN) where it is preserved as a study skin. These environmental modifications create unfavorable changes for the birds not only in the perimeter of the dried lake but also for a radius of several kilometers.

In recent years Colombia has been expanding her highway systems, which cross forest areas and affect extensive natural areas. Birds crossing these roads are in danger of colliding with vehicles; it has been exceptional on my many trips not to find dead birds of

Coragyps atratus, *Crotophaga ani*, *Volatinia jacarina*, and species of *Sporophila*.

There are regions where large areas of land are burned off to improve cultivation and to clear the land of noxious insects. How many birds' nests with eggs or chicks are destroyed and lost in this way?

In 1960 the tablelands of the region south of the Serranía de la Macarena were on fire, covering an area of no less than 500 square kilometers in which grasslands and trees that supported a rich bird community were destroyed. These fires crop up from time to time, seemingly from natural causes.

With the increase in agriculture and technological progress, spraying with insecticides, fungicides, and herbicides has become a common practice. On consuming flying insects, reptiles, or fish contaminated by these chemicals, birds become ill and die. The result of this practice is the decrease of *Coragyps atratus*, *Cathartes aura*, and *Cathartes burrovianus* in the Tolima llanos where large plantations of cotton, tobacco, rice, and other crops are located. Large-scale spraying by planes brings complaints from farmers who feel a lack of these birds to clean the fields of dead animals. These insecticides contaminate the water the birds drink and the air they breathe. Already there are only a few species of Rallidae, formerly easily found in the vegetation that covers the small streams of the sprayed areas. It will be many years before man understands and puts into practice the control of pests by biological methods, not chemical, so as not to displace the balance of nature. In the meantime bird life must suffer the consequence of such experimentation.

In respect to environmental changes created by man, it should be noted that there are avian species which benefit by these alterations: where a jungle is cleared and the land converted into pasture, prospering communities of *Sturnella magna* and *Leistes militaris* are established. As followers of cattle we find in Cuculidae, *Crotophaga ani* and *C. sulcirostris*; in Ardeidae there has been a considerable population increase of *Bubulcus ibis*, a heron originating in the Old World which established itself in the New World at the beginning of this century, probably by a casual immigration through the northeast of South America. This heron follows the cattle and feeds upon insects stirred up by the herds, or rests upon the animals and feeds on the parasites of the cattle. There can be no doubt as to the abundance of this heron in Colombia today.

Our congenial and useful sparrow (*Zonotrichia capensis*) prospers very well in the immediate areas of human habitation. It is a small bird which follows man. One can hike for kilometers and kilometers through land uninhabited by man and not a sparrow will be seen or found, but come to a house and this little bird will be present. In the Bogotá savanna *Zonotrichia capensis* is the most abundant bird. There have been occasions where 10 pairs of birds, and three to four nests, were found in one hectare of pasture land.

Asio flammeus is present in areas covered by the pastures of the Bogotá savanna. This bird, which nests directly on the ground amid the thickest vegetation, feeds upon the rats that abound in the grasses.

Around corn cultivations, and in any zone except the paramos, there have been increases in the populations of *Molothrus bonariensis*, some species of Psittacidae, and *Pheucticus aureoventris*; and in the rice fields there is an abundance of birds in the genera *Sporophila* and *Oryzoborus*. But as they take advantage of crops for feeding, these birds present problems to the farmers and sometimes cause considerable damage, especially to the corn and rice fields.

In the tropical jungles of the canyons of the Cauca and Magdalena rivers, enormous tracts of land already have been converted to pasture and all types of cultivation adapt very well to the climate. The greatest percentage of vegetation is imported, and in this area the remains of populations that once were abundant in their natural environment may be observed.

In reforestation areas few species which formerly occupied the land when it had its natural vegetation are now present. The species which has adapted itself favorably to *Eucalyptus* groves is *Colibri coruscans*. The cultivation of exotic plants for park and garden use, such as *Abutilon* sp., attracts and increases the populations of Coerebidae, especially *Diglossa carbonaria* and *Diglossa albilatera* in the vicinity of cities.

Because of environmental changes created by man, it is natural that permanent residents or native species with preestablished habitats suffer more than the migratory birds. In the last 5 years, however, there has been a decrease, at least in the department of Cundinamarca, in the quantity of migratory birds. Large flocks of Anatidae of the species *Anas discors* have not been seen in the lakes and swamps—which have lost some of their water volume—and it has been rare to see

individuals of *Anas acuta*, *A. clypeata*, and *A. americana*. A large flock of *Buteo swainsoni* passed on October 24, 1963, creating great admiration in this capital. During the months of October and April one finds small numbers of *Coccyzus americanus*, *Caprimulgus carolinensis*, *Chordeiles acutipennis*, *Tyrannus tyrannus*, *Catharus ustulatus*, *Dendroica fusca*, and *Piranga rubra*. The latter attacks the bee hives and is hunted. The same happens with *Dolichonyx oryzivorus* and *Spiza americana*, both of which cause some damage to rice fields.

Mortality in Birds Which Man Uses as Food

Man's use of birds as food has decimated many populations and some species are in danger of extinction. *Tinamus tao* was abundant in the region north of the Serranía of La Macarena, as noted in the first scientific expeditions in 1941–50. From this date to the present day, however, the region, or at least the surrounding vicinity, has been colonized, and in the sierra *T. tao* is heavily hunted for its abundant and delicious meat. In October 1964, as a member of a government expedition, I explored La Macarena with the objective of studying its boundaries in regard to a national reserve, and in the territory crossed I neither heard nor saw the bird in question. The farmers told me that they were already rare. *Tinamus major*, which in its respective subspecies can be found in almost all the levels of dense tropical zones, constitutes one of the principal foods for inhabitants of these regions. In 1955 I organized an ornithological expedition to the Pacific coast regions (Guapi, Cauca) and was able to verify that an individual that sang was as good as dead, as there would be several hunters after it. Not only is the bird hunted but the eggs are highly prized for their large size and delicious flavor. In all the regions where this bird lives it is doomed to the same fate.

The Anatidae, especially the native species of larger size, *Cairina moschata*, is heavily hunted. Migratory birds also are sought. The most common victims are *Anas acuta* and *Anas discors*.

Crax rubra (Cracidae) was abundant up to about 30 years ago in the jungles of the Pacific coast, or so I was assured by natives on my 1955 expedition to Guapi. However, in two and a half months of exploring I was not able to obtain one specimen. Some people keep tail and wing feathers as curios of birds they have eaten.

Pauxi pauxi, hunted in the region of the Sarare (north of Santander), were found as trophies in native homes. Hunters familiar with the region contend it is now difficult to obtain specimens. In the southern region of the Serranía of La Macarena during the 1959–60 expedition, it was still possible to observe in good numbers the species *Mitu salvini*, *Mitu tomentosa*, *Crax alector*, *Penelope jacquacu*, *Ortalis guttata*, and *Pipile cumanensis*, of which specimens were collected for the Institute of Natural Sciences. At this time the southern region was being settled, and the inhabitants hunted large numbers of these birds for daily consumption. At present, with the great increase of farms and farmers, the populations of Cracidae have decreased in alarming number.

In Suba, in the hills northwest of Bogotá, *Colinus cristatus* (Phasianidae) was once common and eagerly sought by hunters. On inspecting the region at the end of 1965, I had the impression that the species had vanished.

Among the Columbidae, it should be noted, *Columba fasciata* was present up to 20 years ago in small flocks at the higher altitudes of the north of Boyacá and in greater numbers in the hills around the Bogotá savanna. These regions have both been explored by me. *Columba fasciata*, because of its size and beauty, was highly prized by the sportsman, and at present one sees a pair or a lone individual once in a great while. The same fate has been met by *Zenaida auriculata*. On my last field trips to the north of Boyacá I observed that *Leptotila verreauxi*, a ground dove of good size and exquisite meat, was already a rarity.

In some regions the larger species of Ramphastidae (*Ramphastos*) and of Psittacidae (*Ara*) are hunted for food. These species are usually found in the jungles far removed from heavy human population.

With regard to the abuse of forest birds in Colombia, it must be stated that in the beginning of this century, especially in the eastern llanos, the great egret (*Casmerodius albus*) was hunted for its beautiful and singular plumes. For colorful plumage the natives of the dense jungles captured the Picidae of the genera *Phloeocastus*, *Dryocopus*, and *Piculus*; Trogonidae of the genera *Pharomachrus* and *Trogon*; and Cotingidae of the genera *Cotinga* and *Cephalopterus*. In Trochilidae the great devastation was done from the middle of the past century to the beginning of the present century by the famous collectors of skins for commercial use. Leo E. Miller, who accompanied Chapman

in 1910 on his expeditions to Colombia, met one of these hunters who daily obtained 40 hummingbirds in the vicinity of the Bogotá savanna. They were captured by blowguns and sold for two pennies each. Today, if a collector were to seek hummingbirds in the same locale, it would be an exceptional day in which he obtained the same number. European scientists took advantage of these specimens and described species which today are very rare and for many years have not been observed.

The Psophiidae (*Psophia crepitans*), Burhinidae (*Burhinus bistriatus*), and various species of Cracidae and Rallidae are in great demand for semidomestication with poultry-yard birds. The chicks of Psittacidae of the genera *Ara*, *Amazona*, *Aratinga*, *Pionus*, *Brotogetis*, and *Forpus* are sought as cage birds, either for their song or their playfulness. Species of Thraupidae (*Thraupis episcopus*, *Thraupis palmarum*), several of the general *Euphonia*, *Compsocoma*, *Dubusia*, *Anisognathus*, and the species *Cissopis leveriana* are hunted considerably. This is also true for *Icterus*, *Cacicus*, and sometimes *Molothrus* in the Icteridae. *Mimus gilvus* (Mimidae), *Turdus fuscater* (Turdidae), and species of *Sporophila* and *Sicalis* in the Fringillidae are heavily hunted.

The Rupicolidae is a family on the road to extinction; its two species, *Rupicola rupicola* and *Rupicola peruviana*, are already very sparse in Colombia. They are hunted for their plumage as well as for caging. In the extensive jungles these birds seek and unite on rocks for their reproductive cycles, and here they are easily captured.

One also finds as hunting trophies *Vultur gryphus*, *Sarcoramphus papa*, *Harpia harpyja*, and *Jabiru mycteria*.

The Future of Colombian Avifauna

The previous material has clearly indicated that avian populations in whose habitats human activity is present become decimated at an alarming rate. The species most affected will very shortly be of small number and decrease day by day until total extinction. Those less affected will progress with difficulty and may establish themselves in prospering populations where the habitat is favorable to their increase.

Unfortunately, it is almost impossible to stem the damage to bird life brought about by the destruction or

alteration of their natural habitat by man, who will admit to no obstacle in his opening and use of land.

In favor not only of survival but also of the increase in the density of the majority of endemic avian species, is the physical size of Colombia. Of the 113,855,500 hectares, only 2 percent is under cultivation and 55 percent is still in natural forest—but it is nevertheless suffering from continual devastation of its timber, especially in the central section of the country. Furthermore, all the cultivated land does not form a continuous area but is distributed in various zones so that species affected by the destruction of their natural habitats have the opportunity of invading neighboring areas, though they face hardships of a forced and rapid invasion. Fearing competition with species already established, they must live segregated, and, when established in the ecotones, at the mercy of and in danger from unknown predators. The interspecific relationships are accomplished under difficult circumstances. It is logical to assume that the invading populations disturb or rupture the preestablished equilibrium of the new habitat, especially in respect to the food chain and pyramid feeding, bringing to a crisis the interspecific relationships of the new community through dangerous competition. Furthermore, as is consistently observed, many species do not migrate with the urgency required by their vital functions, but rather undergo a precarious existence and remain in their old territory which no longer offers them the necessary conditions for feeding and the prosperity of their population.

But the difficulties and stated dangers, I repeat, do not directly affect the greater number of species that populate the nation. Many of those most directly and disastrously affected have representatives in various geographical races in areas far removed from those heavily affected by the human element.

Aware of the necessities and recognizing the characteristics of the Colombian people, it is useless at present to prohibit, especially in those regions sparsely populated by man, natives from taking advantage of hunting those birds which furnish him with food—even those birds that are already quite rare. In my expeditions to the dense jungles of Caquetá and Vaupés I was made perfectly aware that it would be ridiculous to suggest to a farmer of such a remote area that he should not hunt the rare Tinamidae or Cracidae that attracts him with its song in the encircling jungle and furnishes the main source of meat for his family. This

situation will exist for many years in our country. It is an altruistic thought to attempt to control circumstantial events which contribute to the mortality rate of edible birds in these remote areas.

Not only is the man of the jungle the hunter, but progress in transportation, especially air travel, has made it easy to leave the city for remote jungles where there is an abundance of game which is sought more for sport than for food. As for this point, if effective inspections and hunting regulations are enforced, as will be mentioned later on in this article, and which already are in the process of being established, some control may be expected.

The banning of insecticides on large plantations is not an easy matter. Until other methods are discovered to save crops, the agriculturists are forced to use methods available, and bird mortality in cultivated areas is inevitable.

One direct relationship of man with bird life, the keeping of certain species in captivity for pleasure, is not, broadly speaking, a reason for the depletion of the avian population which lives in the vicinity of man. On the contrary, it is a custom which properly directed may favor the avian population which has captive representatives.

To summarize the future outlook for Colombian avifauna, as far as birds whose habitats are in direct contact with human occupation is concerned, I hold no hope for progress in their species, or better, in their subspecies. It is easy to believe, or foresee, that by the end of the present century many birds seen today will be rare, while others already rare will have disappeared from those areas heavily populated by man. But Colombia has enormous unpopulated areas, dense jungles, wild rivers, and inaccessible mountains where bird life may live and flourish, far from man, until man comes to realize and understand the utility and economic value of avifauna. Man must learn to value and protect bird life by using scientific advances as well as seeking to enrich populations of species in danger of decimation.

Suggestions for the Conservation of Avifauna

1. Educate and teach the people to appreciate the wonders of nature.

If a people understand the marvels of creation they will love them, and if they love them will preserve them. Among these marvels of nature, birds are privi-

leged beings through their beauty, their song, their gracefulness, their way of life, and their locomotive facility. But this is not all, for they also exert an important role in human economics by being active agents in the elimination of innumerable plagues of insects and invertebrates who destroy crops and vegetation. Leading bioeconomists have gone as far as to state that without birds the earth would be virtually uninhabitable. A people who observe, study, and understand the marvels of birds will protect them, enjoy their company, and will never persecute them, much less kill them for unnecessary reasons. How fine it is to see people forego cutting their lawns and gardens when they are aware that in the branches of a tree or in the overgrowth of weeds are nesting birds. And if by chance a chick falls from his nest he is gently and carefully returned to his home. A good number of species have maintained the level of their population because of man's friendship. Classic examples are in Trochilidae, with the species *Colibri coruscans* which is abundant in the Bogotá savanna. People have in their gardens flower-bearing plants that are sought by the hummingbird. In Troglodytidae, *Troglodytes aedon* is also encouraged to nest near human habitation for the sweetness and constancy of its song.

This friendship between man and bird life should be stressed more and more in our people, until an almost mystic feeling is born by which no one would dare mistreat our birds. If the capture of birds for food or ornamental purposes were necessary, controlled hunting would be observed simply as a reasonable use of natural resources. Hunting laws protecting rare bird life or restricting hunting during reproduction periods would be respected. Laws protecting edible as well as ornamental bird life have already been passed in Colombia. One of these laws protects the flamingos (*Phoenicopterus ruber*), which were being captured in large numbers to be used in parks and gardens. If the public becomes aware of existing problems, however, man will come to appreciate these birds in their natural environment on our Caribbean coast and will not think of holding them in captivity.

2. Make ecological studies of avifauna.

The Colombian avifauna has been studied by a large group of ornithologists from Linnaeus to the present day. Foreigners and Colombians have cataloged existing species of the country with serious studies on taxonomic problems. They have been able, for example,

to assign to one species five or six geographical races according to distinct localities and distribution. Work has been done in nomenclature and geographical distribution, but very little work done on how our birds live. It is necessary that our ornithologists devote themselves to avian ecology and study at least those species believed to be of economic and ornamental value, or which are becoming rare. Studies should be made on habitat, state of population, feeding habits, voice, plumage, roosting, offensive and defensive conduct, running, flight, size of individuals in respect to sex with their morphology and coloring differences between male and female (dimorphism), prey and predators, information of species before the reproductive period, as well as collecting information of the reproductive behavior of species—such as whether it is monogamous or polygamous, extension of its area, defense of chosen territories, diurnal and nocturnal activities in relationship to seasons and weather, calls and displays of each sex in mate selection and during mating, copulation and conduct after copulation, selection of nesting site, egg laying, incubation, birth and raising of the chicks, leaving the nest, stages of development of the young, internal and external parasites which attack the progeny as well as the progenitors. Also knowledge of the phenomena of symbiosis, be it in the cases of mutualism or comensalism. Finally, the registration of local migratory paths of Colombian birds.

Results of such investigations would lead to the understanding of the requirements of species and their environments: the role in the ecosystem, the most favorable site, and the advantages obtained by belonging to a community of particular floristic and faunistic composition. With such data man may be able to establish the best environmental conditions, at least for species living within civilized areas, and areas which are to be opened. For example, if through expansion of agricultural areas a natural environment is to be destroyed, some trees which are known to be used by birds of the area for feeding and nesting should be left around the limits of the fields, and small areas should be reserved to preserve the native and natural vegetation.

With awareness of reproductive conduct, reasonable hunting laws should be passed for the protection of species likely to be affected.

To promote industrialization of birds, they should be protected in their wild state and ecological studies made for full knowledge of the most favorable habitats.

The feeding and reproductive habits should be observed so as to offer birds in captivity the best environmental conditions required in their reproductive cycle. Species protected in their natural state will raise their population levels and will offer the opportunity of collecting eggs to be taken to incubators where good results may be expected due to new techniques used by poultrymen. This experiment was performed with *Colinus cristatus*, although not with *Tinamus*, incubating four eggs of this species with good results. Unfortunately this was done out of curiosity and not with an eye toward industrialization.

The chicks of *Tinamus*, or of any other bird obtained by this method, would not present any serious feeding problem as experience available from work already done with domestic birds in the care of the young would greatly help in the development of this new industry. Procedures would be developed to facilitate or accelerate the reproduction of birds in an industrial vein.

In this way not only would a new industry be started with our birds that offer abundant and delicious meat, but they would be saved from eventual extinction while respecting those who remain in their wild state. If the Mexican natives, before the arrival of the Spaniard and without the aids offered by modern technology, domesticated the common turkey (*Meleagris gallopavo*) and began an industry so successful that today it covers the world why can we not domesticate and use on a large scale our most useful species to an economic advantage?

Discussion

DUGAND. In 1947 I published a paper on the birds of Atlántico listing 301 species. I am sad to say that since then we have lost at least 57 species, all of them forest birds, due to widespread deforestation. Forests have been cut down and burned mostly for the making of pastures, and also for plantations, but often for no apparent reason at all; and very little of them have been left, just small, isolated patches here and there. This local condition is representative enough of conditions elsewhere in Colombia. It is, so to speak, a preview of the future of the Colombian avifauna, which is one of the richest in the world, with 2,675 species and subspecies. In many sections of Colombia we are literally building deserts through widespread and intense deforestation. This reminds me of a wise sentence by the celebrated French writer Chateaubriand:

"Forests precede peoples and nations; deserts succeed them."

LEHMANN. I would like to ask of anyone here in the audience some idea of the number of eggs laid by turkeys before they were reduced to captivity and domestication. Because, as Dr. Olivares points out, quite a few of our game birds could be reduced to domesticity. I think two or three of our species may lay two or three clutches of eggs a year, enough to make industry of these birds even if they cannot be stimulated to lay more eggs at present. Does anyone know if something like that has been done with the turkey or other species? Our quetzal lays one or two eggs, as far as I know, the tinamous up to five. I do not know if there would be any interest in inducing this bird by artificial means to lay more than two or three eggs per year.

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Avifauna in Colombia

F. C. Lehmann

During the last 25 years a fundamental change has taken place in the management of the natural resources in Colombia and other countries of our continent. This change is mainly manifested in an alarming destruction of forests. Naturally, large tracts of wild forests remain, mainly in the Amazon basin and on the Pacific coast of Colombia. But these forests neither shelter all the species of fauna nor contain all the varieties of flora.

In the mountains of the Cordillera de Los Andes one finds more alteration, or rather, more destruction of the primitive habitat and in some cases a radical change in the ecological aspect. In Colombia the Cordillera de Los Andes is composed of three large branches: Cordillera Oriental, Cordillera Central, and Cordillera Occidental. The first two have the highest summits, reaching in some cases to the perpetual snows of Sumapaz, Chita, and Cocui in the Cordillera Oriental, and of the Pande-Azucar, Huila, Tolima, Santa Isabel, and Ruiz in the Cordillera Central. In the Cordillera Occidental the Los Farellones de Cali is to the south, and the Paramillo to the north. In addition, there are two important mountains which are isolated from the Andean system; these are La Sierra Nevada de Santa Marta to the north and La Sierra de la Macarena to the east.

Except for the last, all these mountains have suffered changes in their ecological aspect. The old humid and cloud forests of the Cordilleras are continually being destroyed for cultivation of corn and other non-permanent crops which are successively replaced by pastures for colts or permanent pastures. These are in several cases improperly worked and overpastured, causing in this way the exhaustion of pastures and the destruction of the productive soil.

In most cases, clearing, farming, and pasturing is done on slopes—low hills (60 to 100 percent incline) so steep that erosion is quickly produced by rainfall which carries the vegetal layer. In several places where

the constitution of the soil is not so firm even landslides are produced. To all these facts it should be added that burnings take place during the dry season and this finishes the destructive work of the axe. These are the prevalent conditions of most of the slope lands of the country.

In the llanos orientales, which previously were used exclusively for cattle, the gallery forests on the border of the rivers have been destroyed for the last 20 years. Here savanna burning is practiced as a method of straw farming (natural pasture). Burnings are produced every time a few sunny days occur; these are naturally more extensive and frequent during the dry season (January to March).

Although vast extensions of tropical forests on the Pacific coast and in the Amazon basin have been transformed into pastures and farming land, the problem is less serious in this region. But the forests on the Magdalena basin are fated to disappear, just as the Río Cauca basin has disappeared in almost all its extension due to the demographic pressure, which increases in an unbelievable rate in these regions. This is beginning to become evident in the llanos orientales with the immigration of peoples from the interior of the country.

The felling of trees without mercy in the forests, which in turn means destruction of the habitat for several species of fauna, has brought about the extinction of several forms, perhaps including endemic types, in vast areas of the country, and the invasion of open lands by savanna forms which were nonexistent before. Continuous collection and observation records are demonstrating this. Some birds which have definitely established themselves in the south are *Leistes militaris*, *Coccyzus pumilus*, and *Columbigallina talpacoti*. Even *Phalcoboenus megalopterus* has migrated north for the pastures and plains of the Cordillera Central. Before it was restricted to the south of Nariño, Colombia, and now we find it frequently in the central

part of Cauca. *Ptiloscelys resplendens* in the same regions is not rare, as is true of *Anas georgica spinicauda*. The stocking of trout in the rivers of the cordilleras has influenced the population of *Merganetta armata* by increasing the food supply.

But for each of the new invading species, hundreds of species which were common before have disappeared. Many people wonder and question what has happened to a particular bird, without realizing that the disappearance of birds is the result of their own way of handling nature.

In the Valle del Cauca plateau, for example, most of the birds which were abundant before have disappeared. The first to be affected were the forest birds. Most of the forests covering the plateau were initially cleared to pasture colts, then they were gradually converted into cereal and cotton fields, and then sugar cane fields. As can easily be understood, this radical change completely eliminated such species. Some of them should be mentioned: *Cyrtorellus soui*, *Mycteria americana*, *Ajaia ajaja*, *Cairina moschata*, *Sarcoramphus papa*, several *Accipiter* and *Buteo*, *Buteogallus urubitinga*, *Falco albigularis*, *Columba cayennensis*, and *Ara severa*. Among the mammals eliminated in this region due to the same cause we can mention *Felis onca*, *Felis pardalis*, *Felis eyra*, *Sciurus granatensis*, *Cebus capuchinus*, *Alonata senicula*, *Aotus lemurinus*, *Nasua* sp., *Potos flavus*, and *Choloepus hoffmanni*, among the outstanding ones. Also the drainage of swampy areas has eliminated some other species: *Hydrochaerus hydrochoeris*, *Casmerodius albus*, *Leucophox thula*, and various species of the family Rallidae.

Recently, the continuous practice of aerial spraying of potent toxic pesticides has contributed to the extermination of several species of ground birds and insectivorous birds that eat the poisoned insects or are themselves trapped by the spray; and on several occasions, even fishes have been the victims of pesticides.

In several places in our cordilleras where we once had beautiful and rich forests feeding abundant and clear rivers and ravines with infinite aquatic life, forests full of magnificent wood and orchids, and innumerable fauna, we now contemplate only a scenery of desolation, erosion, or bare rocks and dry river beds.

What is more regrettable is that when we realize that our woods are exhausted and that the waters which are indispensable for irrigation of the valleys and the establishment of hydroelectric plants or aqueducts are exhausted, we think only reforestation is necessary.

The persons in charge of this work forget all about our native flora and fauna which are nourished there. They forget the scenery and the biological equilibrium and think only about planting exotic species, conifers, and eucalyptus. They think of the forest as an immediate source of raw material for the elaboration of paper, and the systematic destruction of the native trees which still exist in small quantities is continued for this same purpose. These trees include *Erythrina peopigiana* and *E. glauca* and the *Anacardium* sp. of our old forests of the valley. It is necessary for someone to study the native species, since among the 50,000 or more species of Colombian flora there must only be one or more species necessary for the production of wood pulp, and these could be cultivated for this purpose. We also need rapid-growing species in the secondary forests to protect the soil and the sources of water.

Also, one should not forget about hunting, and the pressures that some species undergo due to the lack of proper regulations which would impose bag limits and hunting seasons. Among the species requiring protection from hunting are the cats, deer, ducks, turkeys, paujis, partridges, and torcazas (gray wild pigeon). Modern transportation facilities now give easy access to regions which were before either inaccessible or difficult to reach. Deer are also killed from planes, helicopters, jeeps, or other vehicles.

Our people need a better education on matters relating to nature and on the consequences of the irrational use of it. I would like to see among the technical missions, continuously being sent as advisors, not only economists, engineers of all sorts, and technicians in general, but also ecologists, naturalists, conservationists, and teachers of these specialties who could teach our leaders and the new generations a love and respect for nature, and, on this basis, develop a "rational" exploitation of our natural resources which are now being squandered without mercy.

With the elimination of the gallery forests in the llanos orientales a rich fauna is being exterminated: tapirs, jaguars, ocelots, peccaries, spotted cavies, deer, monkeys of all kinds, and agoutis. Most affected among the birds are the game birds such as pujis, turkeys, tinamous, torcazas, and many others such as toucans and those essentially forest-borne such as Dendrocolaptidae, Formicariidae, Furnariidae, Psittacidae, Psophiidae, and many others. The species needing great extensions of forests to subsist, such as mountain tapirs, spectacled bear, and those which inhabit the underbrush of the

high barren plains, such as the small pudu, the rabbits (*Sylvilagus*), woodcocks like *Chubbia jamesoni*, and ducks (*Anas flavirostris* and *Merganetta colombiana*), are diminishing in an alarming way in the cordilleras. To all that has been mentioned must be added the exportation of and local commerce in all kinds of birds, furs, and game. For each quetzal or gallo de roca that arrives in the United States or Europe, 50 or more die in the hands of the collectors and traders.

In face of this sad general situation in Colombia, I think such urgent measures should be taken as: (1) promulgation of hunting rules (the government is considering a project of regulation on game); (2) the establishment of natural reserves and national parks duly guarded and administered to save some of our untouched areas before everything is distributed by the Agrarian Reform; (3) activate programs of education on ecology, natural resources, conservation, and rational management of forests and soil. I think this is the only way to obtain effective results in the long run.

Our Museum of Natural History is dealing actively with these programs, and, of course, the range of our activities is proportioned by its material and economic capacity. Personally, in addition to continuous work within the institution, I have visited other places in Colombia, such as Bogotá, Manizales, Popayán, Neiva, and Ibagué, with the purpose of making our problems known and engendering a concern for conservation. For this purpose I used visual aids such as films, slides, pictures, etc., quite successfully. People understand the problem better when it is explained objectively and visually.

Discussion

PETERSON. I am a member of the survival committee of the IUCN. In trying to determine for the "Red Book" what birds are in danger in the world (those with a population of less than 2,000 individuals), the one great area where we cannot determine to what extent certain species are in trouble is in tropical America. Dr. Lehmann, quite frequently I have asked you this question: "How many of this species, or that, do you think there are?" You have replied that it was no longer to be found in your own country, but that it perhaps still existed elsewhere. But how do we know that these particular birds are not gone completely—whole species?

LEHMANN. Yes. Some species as a whole, maybe, but most of the species still live in other places as local subspecies.

PETERSON. Did I hear correctly when you said that perhaps 500 forms are gone?

LEHMANN. At least from our list of birds.

PETERSON. Is it not reasonable then to assume that not just "forms" but perhaps full species are gone and we are not aware of it? I think this is reasonable. My friend Dean Amadon not too long ago made the statement that he thought the next 20 years would see a lot of extinction in tropical America. I am not sure that it has not already taken place.

LEHMANN. In my lifetime I have seen many things go.

PETERSON. And butterflies?

LEHMANN. At the Natural History Museum in Paris I saw collections of butterflies from Colombia taken 100 years ago that I have never seen in nature.

PETERSON. This is just some information about that chap who flies birds up to Florida. A friend of mine, Phil Livingston, wrote me that he spent four days at Leticia on the headwaters of the Amazon and found hardly any birds in the area; perhaps he should have gone farther from the city. He said there was a character from Tampa, Florida, who is running quite a business scouring the country for birds and other wildlife and shipping them to Florida. He has the local Indians collecting for him, paying them a peso or two—6 to 12 cents for captives. When asked about birds he boasted that the only ones we were likely to see would be in his local collecting zoo. We were taken to an Indian meeting area where he was offered about 100 captive birds taken from the nets and put in wicker baskets. Most were jaçanas. He refused them all, apparently because he had plenty of jaçanas. The Indians left at the same time we did without releasing the captives. I asked Mike about this. He said, "Well, they don't want them to get back in the nets again; instead they are left to starve to death."

BUECHNER. I am sure all of you will agree that if we did nothing more than publish the information which has been set forth in the past 2 days this whole conference would have been worthwhile. I hope, though, that we can take some action tomorrow, at least in terms of setting forth some ideas that might lead to action programs in various countries involved. Does anyone wish to comment or make a suggestion as to how we should proceed tomorrow?

HOWELL. I think that most of us have seen the areas of common concern and have either mental or written notes on specific things that need to be done, but I would like to have information provided as to what government agencies or international organizations recommendations could be directed. Perhaps Dr. Vogt would be the person to provide such information.

VOGT. Well, I could start it, but from country to country there will be variations. Certainly it is obvious that we should try to get to AID, which is doing more harm than good as far as conservation is concerned; and in many countries we might get them to work a little on better land-use patterns. And I should think that Fish and Wildlife would take up some of these problems—migratory birds, possibly—and somehow I would like to get back to the signatories of the Nature Protection Treaty of 1940. That is about 12 countries.

BUCHINGER. No, there are 13 countries, because in the last few months Brazil ratified the treaty and Panama signed and ratified it. Unfortunately there was absolutely no publicity about this. This was sort of disheartening for the politicians. Carlos Lehmann can tell you that Colombia was ready to ratify the treaty soon after Brazil ratified it, but as there was no publicity involved the politicians lost interest.

If I may suggest it, perhaps tomorrow we could draw up two recommendations: one referring to what should be done in the United States, or what can be done, and then one which advises the countries that such recommendations were made and might bring help, if they are adequately linked to similar policies in Latin American countries.

VOGT. I think that might come under the province of a treaty, but AID generally says it will not make recommendations; it has to have the recommendations or applications come from the respective governments. One of the problems is to get these governments to take action or make requests or recommendations.

BUCHINGER. We have international alliances, and all agreements have certain strings which were attached to them here in the United States.

In several instances the beneficiary government asks for something which it does not receive. In Argentina three AID programs have stopped because the Argentina Government was asking for ecological surveys before any interventions in the ecosystem had been made.

Another example of lack of ecological considerations in programing can be seen in the notorious case

of the banana plantation in Ecuador. The sponsors are quite unhappy about the delay in developing a big-scale program and blame the government for its lack of interest and cooperation. But let us see what did occur. To boost the economy in the region of a roadless area the hill slopes were deforested and bananas were planted. The banana stands were attacked by insects and an ample supply of DDT and other insecticides were provided to the Ecuadorians. The insects which attacked the bananas were controlled, but at the same time so much insecticide was absorbed by the surrounding waters that the fish in the nearby rivers died. Consequently, some 2,000 fishermen were handicapped in their business. The 20 families who would have profited by the banana crop did not fare so well either. They could not sell the fruit as there are no roads in the region on which to transport the ripe bananas. So, correctly, the government decided that in the future it is going to look more carefully into the ecology and economy of development plans, and this stopped or slowed down several foreign aid plans. I think it would be helpful if a recommendation would go out from this meeting that an ecological survey should be made before any intervention into the ecosystem. If such a proposal cannot be followed up, the development agencies evidently are not doing quite what the countries are asking for. You know in this line that the Corps of Engineers has been working on some projects in Panama that have caused quite a controversy. I think Mr. Eisenmann could tell you more about this.

EISENMANN. Somebody mentioned that the passage of a law in one country is likely to help adoption in another. I have noticed this in Panama. Mexico adopts certain "socially advanced" legislation. It may be unnecessary in Panama, but before long it will be introduced in the legislature there. Maybe Costa Rica will pass the same law, and Colombia, too. Latin American countries are most likely to imitate each other in legislation. The feeling is that if something is good for one, it may be good for another. Of course, we have much the same situation in the United States. A law passed by one state legislature is likely to be adopted by others. And conservation legislation is often widely adopted once it gets such a start.

VOGT. But, Gene, what do they do after they pass the law?

EISENMANN. Often they pass other laws! One gets the impression at times that recognizing a fine prin-

principle by adoption of a law is regarded as more important than practical enforcement. However, in referring to imitative legislation in Latin America I had in mind certain labor laws, which I believe began in Mexico.

FOSBERG. I was talking to David Bell, the administrator of AID, not long ago. I asked him, point blank, if there was any mechanism in AID where their mistakes could be pointed out to them and corrected. He said, "Why certainly. Send a letter to me. We are very particular about such things, if only we find out about them." And I think that if the people here could actually formulate, not generalities, but specific things that have been done by AID that have turned out to be very ill-conceived, and these could be sent—addressed to David Bell—some of it would get through, and I think, perhaps, we might see some changes. Once this kind of thing gets into their thinking and is called to the attention of the responsible people, from above, they perhaps would think twice about doing it the next time. I think that this meeting could very well produce a series of such examples to be called to Bell's attention.

VOGT. I think this meeting should commend the Fish and Wildlife Service for the surveys and censuses they have started and do everything we can to encourage the continuation and extension of these censuses. If we could have just started 25 years ago we would be in a lot better shape!

ALDRICH. That is one thing, Bill, that could be done through the U.S. Government. It is about the only thing the Fish and Wildlife Service can do that I can visualize in this program about which we are talking. The migratory bird research angle is about the only thing that we can tackle at the present time that we have the authority to do. And also we have the facilities to do that. So if we could get some encouragement to proceed with that program and get adequate financing for it—then we could do a job. But we do need more support. There is no question about that.

HUMPHREY. John, does not the Fish and Wildlife Service undertake field studies on the distribution of migratory North American birds?

ALDRICH. We are doing fieldwork in the geographical distribution of migratory birds all the time. Do you mean doing fieldwork outside the United States?

HUMPHREY. What about the possibility of combining that sort of activity with, let us say, the study of the total avifauna of an area in the range of a particular group of North American migrants?

ALDRICH. That would be a legitimate problem for us if it is significant in understanding what is happening to our migratory birds. Yes, that could be part of the research that I am talking about, that we would be qualified to do and justified in doing because we have legislative authority. We are at all times restricted by authority given to us by Congress. Some times it looks like inaction on our part when actually we are limited by congressional acts in what we do.

FOSBERG. Do you have any arrangement with AID to carry on work under their auspices in foreign countries?

ALDRICH. No. There are no connections with AID whatsoever, as far as I know.

FOSBERG. The Geological Survey, for example, has a foreign geology branch which has no money of its own, but AID furnishes money for it to conduct geological programs in various countries where aid is being extended.

ALDRICH. As far as I know we have no connection of this sort. The limitations of government agencies are extremely complex, chiefly because of congressional acts and appropriations. I mentioned the foreign game bird introduction. That is something the Federal government has no control over. It is strictly a state matter. There is no Federal law against the importation by states of foreign game for liberation. So all we can do is to help the states do a better, more scientific job of introduction.

PETERSON. Is there a Federal law about song birds?

ALDRICH. There is a Federal law about the liberation of imported song birds, yes.

PETERSON. What is the difference in philosophy?

ALDRICH. I do not think there is any philosophical difference, but that is the law. Laws are not always based on philosophy.

HELPS. Colombia has furnished an escape valve for us. The birds that Colombia exports take the pressure off Venezuela; however, the pressure on the red siskin, an almost exclusively Venezuelan bird, in danger of extinction, is about \$25 million, and continues because there are over one-half million canary fanciers in the world who seem to be willing to pay about \$50 for each bird. They cannot be bought in Venezuela legally, so there are some clandestine exports through Curaçao. This situation shows the need for better international cooperation. We should unite and help each other.

Closing Plenary Session

BUECHNER. As an opening observation, I would like to recall Marston Bates' focus of attention on the whole ecosystem. The avifauna is, of course, only one component of that whole system. If we are going to do something in the way of conservation of avifauna in any country, we have to consider it a component of a larger system. It is that larger system that we have to work with primarily, as was so effectively brought out in the paper by Hernández Corzo. I would like to encourage you to keep in mind this larger whole. I think one can conclude, from what has been said, that the North American migrants that winter in Central America and northern South America are not at this time in any grave danger, because they are so well adaptable to different kinds of ecosystems, and that many resident species are already in precarious situations, particularly where forests are being cut down. What happens in the next 20 years is really critical, and perhaps for that reason this conference is extremely timely, coming at a time when there is still an opportunity to change the conceptual environment. We said yesterday that one approach might be to have persons from each of the countries abroad give their ideas on what might be done in the way of conservation programs—in the way of action programs. I think this is a good starting point, and I would like to call on Dr. Hernández Corzo to give us the first talk in this series. Yes, Dr. Vogt.

VOGT. Excuse me for interrupting, but, as a procedural matter, I should like to make a suggestion. I do not think that the committee as a whole can write resolutions or recommendations, and I wanted to suggest that the Washington group be charged with that. Perhaps John Aldrich, representing birds and the Federal government (not officially, of course); Bob Dorney, representing Latin America and knowing Latin America; and Ed Graham, representing the Conservation Foundation, can be charged with formulating resolutions and recommendations in the light of our discussions at the end of today's meeting. They will all be here. I thought that if this is a sound technique, it might be useful to bear in mind as we get the recommendations from the various countries.

HERNÁNDEZ CORZO. I did not prepare in advance my recommendations or proposals for possible resolutions. I merely have here a few notes, but I think that some of the points might be useful in considering further resolutions. I have divided my notes into two main sections because most of the resolutions should perhaps be carried out in our own countries—I mean by ourselves rather than by an international group of countries or through international action. To begin with, and for national action in Mexico, what I have here is as follows:

In the first place, I want to insist (and forgive me if I am being too insistent in this) on our point of view of the economical aspects regarding wildlife and the necessity of resorting to economic incentives for the protection of natural resources as a whole. And I want to insist because perhaps you do not know that for the first time in Mexico at the higher level of the public administration, in the Ministry of Agriculture, Forestry, and Wildlife, for the first time in our history we are now preparing a plan for the development of land, cattle, forest, and wildlife. This is really a new thing in public administration in Mexico, and I think, since it is a technical plan, it will greatly help in developing the criteria and techniques and practices of natural resources utilization. Now, of course, when you speak of land use or the use of forests or the raising of cattle, and, in a minor degree, the utilization of wildlife, you expect, or at least people expect, to obtain economic results, to obtain something for the betterment of their living, for the raising of their standards of living, so this is an economic plan. In Mexico, for instance, as I explained yesterday, we are forced to put economic before aesthetic aspects. Besides this I want to emphasize that in handling natural resources we have to speak of a unit and not about land, water, forest, and wildlife as separate entities.

Secondly, I want to emphasize the need for publicity and education by all means—radio, television, and moving pictures. In this connection, naturally, a good interchange of material is in order. We are just beginning, perhaps along with other Latin American countries, to prepare our radio talks. We have had

some written material for a long time—I mean books, booklets, or brochures explaining the right or wise use of natural resources. We have not made much use of radio and television films. Now we have several films prepared in the Wildlife Department, and other films are being prepared for the Forestry Department and for the Department of Agriculture as a whole. Of course, all this material is at your disposal. Whatever we can partake, be assured that it is at the disposal of other countries, and at the same time we would like to receive in interchange some material of yours to be used in our own country.

Thirdly, in Mexico—and this is important to the subject of our concern here—we will have to accentuate our campaign, especially in our great cities, against the tradition of keeping birds in captivity. You know that by really old, old, tradition our people down in Mexico are very fond of having birds in cages. Naturally there are families who take good care of them, and by “good care” I mean a nice and beautiful and bright cage, and good food. But there are other families which are very poor but who yet insist on having dogs, and cats, and birds, so we will have to continue educating our people against this use. And in this, of course, you American people can help a lot, because we are also beginning to have more and more American visitors insisting on bringing into the United States birds for the same purpose. I know you have laws—I am not very sure, but I am practically sure that you have laws restricting the use, or perhaps prohibiting this custom. Anyway, I receive an average of two or three American tourists per day in my office asking for sanitary and export permits to bring animals up here, so you may help in restricting this possibility by educating tourists not to take live animals from any other country—which, by the way, will also help from the point of view of sanitary considerations.

Now, point number four: In Mexico, of course, as I said in my talk yesterday, it is important to emphasize the establishment of refuges and special areas for the protection of avifauna. We have made a good start since last year, and this is why I spoke about Rasa Island in the Gulf of California and now mention Tiburón Island. And perhaps we will begin next year with the separation of a good area close to San Blas on the coast of Nayarit, which is really a wonderful area for the development of avifauna. For this purpose you certainly can help. Of course, the United States is the country with the greatest experience in this connection. You have, as far as I know, more than 300

special refuges for wildlife. Your system is really very good, although I know that you are not satisfied yet. Anyway, it could be a wonderful example if you would intensify the publicity about your refuge system, especially with the intention of illustrating it to the Latin American countries, and also emphasizing the practical aspect of your policy. Because refuge areas, of course, have a great practical aspect in the case of our Latin American countries, being areas for recreation, areas to enjoy the natural environment—and this, of course, means money and health—it also means dollars, it means tourists. And if you would help us in educating the type of tourist that should go to Mexico—I mean instruct them about how to behave, especially when in these areas (not to make any collection of animals nor buy them because it is against the law, etc., but to really appreciate the fine things of our nature)—then I believe we would be doing a wonderful job of collaboration. And the main point here would be, of course, for you to publicize much more, as you do for your own people, to publicize your system of refuges for the benefit of our countries. I speak, of course, primarily about Mexico.

Now, from the point of view of international action:

(1) In my opinion you may help if you also, in your publicity here and especially that for export, insist on the economic value of natural resources as a unit. I insist on this because we should not forget that you are the leading country, that you are doing a fine job in leading the opinion of the whole continent about the wise utilization of natural resources. If you do this, not only in a helpful way from the point of view of scientific principles, but also enthusiastically from the point of view of international relations, then you will really be dragging others' opinions, others' ideas along with you. Of course you may count on our cooperation, and you will do a much better job than you are doing now.

(2) Interchange of laws and regulations concerning wildlife, natural resources, and especially avifauna. We have not done very much in this connection yet, again speaking for Mexico. We have the brochures and booklets with our laws, in Spanish of course, and you are distributing them and sending them to all parts of the country. Not very much has been done about translating them, especially translating them into English. As a matter of fact, not much has been done, first because of difficulties about the language, and second—or perhaps this should come first—because it costs a lot, at least by our own budget standards, though it would perhaps not be very much for some of your institutions

which could really do a very good job in translating and disseminating these laws, particularly if you could send them to the tourist departments, or tourist offices and organizations. It is my impression that most of the American tourists, especially hunting tourists, going to Mexico still believe that there are no bag limits, no gun regulations, and that they do not have to ask for a permit. They are upset when the game warden confiscates their arms. We hear of these experiences along the border, especially in connection with white-winged doves. I have here a report on the collaboration we are doing with the Wildlife Management Institute of Washington, and part of it is a list of more than 12 American tourists who were fined in Mexico for violations against the hunting law and had their guns confiscated. I have a very, very sad example in this connection, about which I will not speak because highly important people of the United States are connected. The American Embassy, of course, took a stand with our Foreign Department, and names appeared in the papers. But this is really a very bad thing that we can very, very easily avoid just with some publicity or warning.

(3) We must continue to establish, or emphasize, or enlarge the collaboration work along the border. This is already under way in Mexico—I mean, between the United States and Mexico—but not along the border with Guatemala and Chiapas or Campeche. Judging by our experience with the United States, this is really something that helps, and helps a lot. We do not have to interchange wardens—I mean, to give to the wardens free passes across the border, not at all. It is enough that your customs officers know Mexican laws and that when someone tries to get in with excess bag limits or with something that is against the law, he is stopped at the border and sent to the authorities. We are taking care of our Mexican violators, and American wardens are taking care of American violators, so there is no complaint from the point of view of international relations. On the contrary, this has been working very nicely for the last 12 months between Mexico and the United States. I heard somebody here speaking about the lack of collaboration between one country and another in Latin America—I mean south of Mexico—and I think that you could take our collaboration work as an example. It will really help in your countries too.

(4) The preparation of scientific and technical specialists. I said yesterday that there is a strong drive in Mexico for our economic development. And a very

important part of this is the preparation of professional people. Technicians at any level, from qualified workers up to the research workers. We have good schools, especially the large schools in the larger cities. But we still need so much more. We need especially to prepare our people for certain particular subjects. For instance, short fellowships would perhaps do a much better job than long-term fellowships. When we send someone to the United States to get his master's degree or his Ph. D. or M.D., he stays for such a long time that perhaps at the end of 3 or 4 years he does not want to go back to Mexico, or, if he does go back, he sits down and waits for everybody to bring him everything, and to pay him high respect as a very great scholar, or everything must be brought to him for the great work he is planning to do as a doctor. And then he, of course, does little for the betterment of the country. Whereas, it would do quite a lot of good if we could send people here for 3 or 4 or 6 months with a fellowship to be trained, for instance, in the aspects of pesticides in wildlife, the biochemical analysis of pesticides in birds, or in the techniques of banding, or of marking or censusing areas, with the use of transistor aids, or things of this kind.

Now, there are also two points which are really big points, perhaps not for immediate action, but I want to raise them now because I know they are very important. We should in the continent (I am really speaking about the continent) have a great banding program for migratory birds. At present only Canada and the United States do any banding. In Mexico, we do not know the techniques of banding and censusing of migratory birds, so the work that you do and that the Canadians do really stops in the middle of the continent. Every January U.S. census people are received in Mexico. They go for 1 or 2 months with a fine airplane, and three or four biologists count along the coasts of Mexico and even in the central plateau. This is for your information, and our information, but it could mean much more if we could participate in the program. Of course the main fault is ours. We should have a better organized program and I know that we will convince our higher authorities to allocate part of our budget (our annual budget) for the active participation of Mexico in continental banding and censusing programs of migratory birds as a major operation. But it would help a lot if you would make the start—I mean not just showing how things have to be done—not just doing the showing, but to take the initiative in this area and do something in the way of

an international proposal. And finally, (5) I would like to see that the proposals and suggestions or recommendations of this conference should be considered against the general background of the environment or ecosystem ideas, and from the point of view of the urgent necessity of recreation for human beings nowadays.

FOSBERG. In connection with the first two points that Dr. Hernández Corzo brought out, we must, of course, agree, but also, in relation to these same points, every day we hear about the way insects are developing resistance against pesticides. Resistant strains appear, and then we are back where we started after a few years of using a particular pesticide. However, there is one thing that might be called a pesticide against which no known resistance is developed. This is an insectivorous bird. Dr. Hernández Corzo brought out that this should be put in an economic context, and I think that this is possible concerning birds. You could very well imagine plans or suggestions made to the economists, a practical people, to encourage this very economical pesticide which costs nothing and against which insects will not develop any resistance. This is just one more thing that might be brought up at an economic conference.

IBARRA. I have heard many interesting ideas about protecting the avifauna of our countries. Early this morning I was thinking about making some suggestions for protecting birds. Among them was to invite those countries that have not signed the continental treaty for migratory birds to do so. Signing this document would be of great help in the near future.

Referring to the discussion about insecticides, I must talk about my own observation of chemicals in my country. The results of the application of deadly chemicals to crops give me a pessimistic view for the future of bird populations, especially the insect-eating birds. In Guatemala there is a need for proper legislation for bird protection and an urgent need for education of the people. We often talk about education and consider it one of the most important and productive ways to promote conservation. Educating large numbers of people about specific matters is not easy, but if we do not try it will become increasingly difficult to stop the killing of birds.

A few days ago I translated into English some paragraphs from my papers written in Spanish. In one I talked about an ornithologist who had visited Guatemala in 1924, at which time he noted that the Guatemalan national bird (quetzal) was indeed very scarce,

despite the law protecting it. The fact is that we do not have sufficient means for extensive publicity about the national importance of this beautiful bird, as well as other useful species.

Another point of interest is the establishment of two natural history museums in Guatemala. One of the main objectives is to illustrate, with recommendations from conservationists, why people, especially children, should not kill birds because of their usefulness; for example, the hawk destroys harmful rodents and insectivorous birds feed upon insects that destroy our crops. I must say that these museums are visited by thousands of children every year, the same children who in the future will be ardent conservationists. I consider that this kind of center is enormously helpful in educating our people.

The publication of magazines and articles in the newspapers will help our conservation program. In the past years I have been publishing notes in the most important newspapers in Guatemala. The effectiveness of children's books on conservation needs to be brought to the attention of Latin American countries. Dr. Hernández Corzo pointed out that books on conservation published in the United States might be translated for the benefit of those Latin American countries who do not stress conservation. This is an excellent idea.

Some Guatemalans identify conservation with sentimentalism, not realizing its significance in the national economy and the importance of national parks and refuges in enforcing conservation. The famous Atitlán Lake in Guatemala, which I believe is the only refuge in Central America, protects the Atitlán grebe with the cooperation of the World Wildlife Fund and the Ministry of Agriculture of Guatemala. I know that Mexico, Argentina, and Colombia have several national parks by now, but in Central America we need to establish more refuges and national parks.

I would like also to talk about the bird markets. I have observed several such markets in Central America and they should be forbidden. Many people buy birds, ignoring the importance of having them free.

CLEMENT. Dr. Ibarra's statement raises an important action point when he reminds us that there are European manufacturers who are using chemical pesticides in his country. Can anyone tell me which company?

VOGT. One of the principal manufacturers of insecticides in Guatemala is Monsanto.

CLEMENT. We Americans can help by pointing out our own experience to our Latin neighbors. I think we have outlived this particular phase of the use of pesticides and are rapidly bringing it under control. So we can share information along these lines and help you convince other people that this is being badly overdone.

LEHMANN. I think that we should recommend ratification of the Washington Convention of 1940 by the few countries that have not yet done so. One of those countries is mine. I have been working in my country for several years on the minister of agriculture and the minister of foreign affairs to present it to the Congress for ratification. Having this, I think we will have a means of putting a little more pressure on the government officers. I understand a new convention or a new treaty is being prepared that may be more effective than the 1940 treaty, which I understand was adopted by Dr. Wetmore and other people.

Of course, I think one of the more practical ways of protecting the avifauna, both native and migrant, is by establishing national parks and equivalent reserves to protect immediately both wildlife and forest flora from the fast rate of destruction some of us have in our countries. Mine is one of the worst, perhaps. If we do not set aside these areas and we cannot protect them within 5 years from now, it will be too late to protect some kinds of habitats.

I think we should also try to stop this terrible commerce in caged birds and the commercial use of game animal skins.

Despite the treaty under which birds that are protected in the country of origin cannot be imported into the United States, smuggling exists, as in the case of parrots. You do not let people import parrots here, but they are smuggled in through Mexico. Our exporters send them to Mexico and your tourists smuggle them in. I know that because this gentleman that I mentioned yesterday was permitted to export monkeys to Harvard. He asked me to help get monkeys from southwestern Colombia, since he is located in the upper Magdalena. He said since you are helping export these monkeys, why not help get parrots from the area. I asked where he would send the parrots, and he answered, "to the States." I asked how he could send parrots to the States. He said it was easy to send them to Mexico and have tourists smuggle them in in the trunks of their cars.

One important thing we should do is to sponsor local institutions that are interested in conservation. Most of our people do not know what conservation means. For us to use a forest means to destroy it. Our international bank is now beginning to lend money on long terms to people who want to reforest with commercial varieties of native trees, including pine. Within 20 years a planted forest can yield an average of 6,000 pesos a year per hectare, which is more than some of the crops, like poor corn, planted in these same mountains. Forest planting rebuilds the habitat for birds, and also helps keep the soil from washing away and restores and improves the dry river beds we have there.

BUCHINGER. I would like to point out only that the manufacturers are not the only ones who should be stopped. It would be good to ask AID to stop its representatives from giving free samples of pesticides away. Yesterday I mentioned what was happening in Ecuador in the banana plantations. All the pesticides which created the problem came from the United States.

CLEMENT. If Dr. Lehmann and his colleagues in Latin America will tell us where unique accessible habitats exist, we can help steer tourist traffic to these areas and in this way provide a basis for showing how important they are. There is a tremendous increase in this type of tourism. People want natural history guidance in circling the world and visiting various continents. My own organization can perhaps be quite helpful in this respect because we are in touch with the public.

LEHMANN. It is very, very important that it was pointed out here, both by me and someone else, that the book on the birds of Colombia is of little use to local people. In the first place it is in English, and in the second place our people do not know ecology, or let's say amateur ecology, as you do here in the United States through the use—for many years now—of the excellent Peterson guides. We sell the book at the museum, of course. Most of the people who buy the book are Americans. The Colombians who buy the book, even though they speak English, often come to me with sketches of birds they have seen in the field but have not been able to locate in the book. However, publication of this book steers tourists to Colombia to see the birds, and that is a good sales-talking point for national parks. If with the establishment of this park we can bring tourism here, that means gold to us—that means money.

CLEMENT. I think part of my point is that we are now at the stage where we could begin working on a bird-finding guide to Latin America.

LEHMANN. As you know, I am preparing my own book on birds of Colombia with keys from the class down to the family. I just asked Mr. Eisenmann yesterday to help me in the keys for passerines, which are very difficult; but with the other groups I have already made keys that work with the illustrative sketches to show details. I am doing this work with a Canadian friend, Phil Brown, who is an excellent photographer and film maker. He is an engineer and a geologist, and during the winter months when he cannot follow this work, he comes down to the tropics and we work on this book. In the beginning we had the idea of publishing the book in English, because we thought we could sell 10 copies in English where we could sell one in Spanish. But when I consulted my colleagues, all protested, so I have translated most of it into Spanish. Of course I am keeping it up to date. My main problem at the moment is that I have not the money to pay for someone to make the illustrations. I have made some myself, but still many more have to be done. I would like to see this book with as many color plates as possible.

SHORT. There are continuously published in this country many very fine articles concerning various areas in Latin America. It seems to me quite appropriate to suggest that an organization be set up (and subsidized) along the lines of *Reader's Digest* to abstract such articles, translate them into Spanish, and sell them at relatively low prices throughout Latin America. Something like this would probably be very effective.

IBARRA. Obviously we mostly need books which are not entirely technical. We need to educate children and the general public. Dr. Peterson published an interesting book recently, and it is my opinion that books like this one should be translated into Spanish.

BUECHNER. For the benefit of some of you who came in later, Dr. Vogt suggested that we have a committee made up of Drs. Aldrich, Dorney, and Graham to formulate recommendations for this group after the meeting. We can express ideas as to what might go into the recommendations, but we will not adopt resolutions during the conference.

RUSSELL. British Honduras has the same problems as the other localities. There is a long-term need and there is an immediate need. The immediate need is to preserve two vanishing habitats. These are areas of the rain forest that are still intact and some sea bird colo-

nies on the barrier reef. The long-term necessity is for an educational program. We have had considerable discussion about that.

My feeling is at this point—with an hour and 15 minutes to go—that unless things take place rather rapidly, the only outcome of this conference will be in the form of resolutions. These resolutions may be passed on to representatives at the conference and to their respective governments. I may be overly pessimistic, but I do not think resolutions will help that much. I think we have had some very able people at this meeting who are influential enough in their countries, and they have had difficulty getting the things done that need doing. What are we going to do about it? We do need some sort of follow-up after this conference. I may be wrong. Maybe other people have more respect for resolutions and think they will influence governments. I rather doubt that they will. I do not feel that the United States should be the country that initiates subsequent actions. We might be able to provide some of the funds and some of the technical help involved. I think an international group including representatives from all of the Latin American countries involved, and not associated with an organization in the United States, would be most effective. As far as the actual formation of such a group is concerned, I hesitate to suggest creation of a new organization to put something like this into effect, but I do not know where an organization exists that can handle it at present.

This is a conference called to consider the effects of habitat changes on population levels of birds. I think that we have all recognized that birds are not the primary concern here. The primary concern deals with habitat changes. I will acknowledge that birds may give us the contact that we need for publicity and educational purposes, and we should use them for that purpose. Our main objective, I would hope, would be the conservation of habitats. To further this objective perhaps it may be practical to have an international committee of biologists which may include ornithologists, zoologists, and ecologists, to provide a pool from which various countries could request information or recommendations on conservation matters. Ideally, many of you here today representing Latin American countries could influence your government to the extent of asking for aid from this international group. Or if you do not think you could persuade your government to ask for aid from this group, perhaps there are other ways of obtaining it.

If biologists representing three or four different Latin American countries were to visit another Latin American country, and if they could spend a few days there, half their time spent in practical politics and the other half in making practical recommendations on conservation matters, that would accomplish something. I do not feel that resolutions will do the job. In British Honduras, for example, although I know very little about its government, particularly since it is changing so rapidly, I do think that a visit from biologists emphasizing the things that we have discussed would have some influence; and I feel this approach might do some good in other Latin American areas.

VOGT. Well, there is, of course, an International Committee for Bird Protection, with a basic responsibility, which might be a vehicle for working on bird conservation, particularly in view of the fact that we now see it primarily as habitat preservation. I do not think we should center this too much on Latin America, because the United States is probably the most, or one of the most, destructive forces in Latin America.

Someone yesterday spoke about the way we are helping them to knock down trees. The point is that they are not doing it wisely. We are cutting death rates without helping to cut birth rates. We are more responsible for the population explosion in Latin America than almost any other country, including the nations involved. So we have a responsibility there.

I should like to offer just in capsule form some suggested resolutions—I will not try to formulate them—that the drafting committee can work on if you people will approve of them, just in the interest of saving time.

First of all, we owe a debt of gratitude to the Smithsonian for its hospitality and the excellent work it did in organizing the meeting. I should like to see a resolution congratulating the Department of the Interior on the censuses that they have been conducting, asking them to seek similar censuses in Mexico and Canada if it is possible, and to extend such censuses here. I'd like to see some kind of a resolution urging AID or the Alliance for Progress to give high priority to maintaining the biological productivity of the environment, especially soil, water, and the fauna and the flora, which they have disregarded, particularly in relation to the agrarian reform program, which is turning into a major destructive force in Latin America. I suggest that we urge the National Science Foundation to promote research on ecology, with special emphasis on birds in tropical America. The U.S.

Department of the Interior might be urged to cooperate with Mexico to help give better protection to birds, particularly since American nationals are so often involved in law violations south of the Río Grande. We might nudge the State Department, suggesting that they control American game hogs abroad, among whom, unfortunately, one has to include two or three well-known ambassadors; and I'd like to suggest a resolution asking the Pan-American Sanitary Organization to evaluate the effects of insecticides on the ecosystems of Latin America: the effect on birds, on fish, on human beings, on soil. It could be a major project and I think it is one of increasing importance and something that we need to do as soon as possible. And finally there is, as you know, a move in the United Nations (ECOSOC and UNESCO) to control the trade in wild mammals and birds, or all forms of wildlife. I think it might be a good idea if this conference went on record supporting this attempt in the United Nations.

BUECHNER. Dr. Vogt mentioned AID, and I think it is appropriate at this time to read to you a statement that Dr. Ripley handed to me at the beginning of this meeting:

Resolve that this conference on Avifauna of Northern Latin America, meeting on April 13–15, 1966, urge AID (the U.S. Agency for International Development) to insert a special provision or clause in any agreement with a Latin American nation or agency, in respect to the construction of any dam or hydroelectric facility. That provision shall be made for providing forest guards, including their transportation, in watershed areas associated with such construction. These provisions shall include the negotiations of funds to be provided either by AID or by the nations concerned.

CAHALANE. I think that is fine as far as it goes—I suggest we incorporate the ideas in a broader resolution, as was suggested by Bill Vogt, touching on all aspects of natural resources as they are affected by AID operations. As the present chairman of the bird protection committee of the AOU, I'll do everything possible through the committee to urge the Union to promote research in Latin America, either through grants, if that is possible, or by encouraging its members or others to do research on winter bird habitats in Latin American countries. I believe that we need a lot more information on the details of what is actually happening to bird populations in many of those areas.

HOWELL. I think that we have all heard enough "horror stories" to be fully aware that there is a very acute short-term problem, and there is, of course,

a long-term problem as Dr. Russell mentioned. There is no question in anyone's mind here, I know, that the essential problem is the preservation of habitat and how this can be done. One thing that was mentioned earlier was the agrarian reform program and what effect this is having on encouraging the destruction of forest habitat because it is considered land that is not in use. Well, we certainly want to know specifically what can be done about this. AID was mentioned yesterday as welcoming suggestions that would be appropriate for improving the administration of this agency and its program. I'd like to suggest that AID receive a resolution or suggestion from this group (or from any individual who has the ear of the agency) that it would be advisable if, instead of requiring that land which is not in agricultural use be put to such use or be confiscated by the government, an alternative could be that such land could be retained by the owner if it were used for purposes which were compatible with the preservation of at least part of the forest, even if there was selective cutting under sustained-yield management. Certainly some forest is better than no forest at all. If this proved to be impractical, perhaps some form of tax exemption for preservation of forested areas could be granted. Some of these areas must be set aside as natural preserves or parks (or something that would help to preserve the habitat) because if not preserved there is not going to be any long-term need. I'd like to suggest also that we give more consideration to working through private individuals in Latin America as well as government agencies.

As I stressed yesterday, in Nicaragua there are a few very wealthy families, highly influential both socially and economically, who control large areas of land. I think that if these people could be appealed to, there might be some chance of setting aside some areas. I'd like to see some suggestions as to how one could get through to such individuals in other countries as well, because I feel sure that similar conditions exist elsewhere. Again, I feel that appeals to national pride would be quite important in this. In Nicaragua, for example, a national park dedicated to Rubén Darío or some other national hero would probably be widely respected. Having a national bird of a spectacular kind would be very helpful in publicizing projects to save the habitat of threatened species. As for other short-term needs, such as limiting the exportation of rare species as caged birds—as long as there is money in this, all the passage of laws locally will not do much

good. This is something about which I think the United States could do something. I believe I am correct that most of the money in this business comes from the United States.

If the United States prohibits the importation from Latin America and other areas of all threatened species of exotic animals, except by legitimate zoos and recognized agriculturists, then the practice would virtually stop. On a long-term basis I feel that the United States should take the lead in preventing the introduction of exotic species into places where they do not belong. A hundred years after the introduction of the English sparrow and the starling we should know better, but still there are agencies within the United States promoting the introduction of exotics. It should be obvious that this is usually wrong in two respects. Either the introduction does not take, in which case it is a waste of money; if it does take, it is likely to be disastrous for some of the native forms. This goes not just for birds but for fishes, as we heard yesterday, and probably for a great many kinds of plants, too. As for long-term projects that emphasize the economic value of conservation, I certainly think there would be no objection at all to charging a reasonable but handsome fee to tourists coming to visit national parks and natural preserves in Latin American countries. Anybody who can afford to go there can afford to pay an entrance fee such as we have in our own national parks, and this source of revenue would make clear that setting aside such areas is not a dead loss economically.

As for educational matters there is not much that I could say to add to what has already been said, except to emphasize a point made yesterday that we need good field guides and good illustrations. It costs no more to reproduce a good color plate than a bad color plate, and there are plenty of extremely capable bird artists and illustrators who could do the original work. The same thing might be said for the lost art of taxidermy. In many parts of Latin America almost the only means of learning about wildlife is to visit small local museums and see only a series of poorly prepared stuffed birds. Dr. Hernández Corzo suggested that there are opportunities for sending people to the United States or some other country where such things as taxidermy are taught. Many such specimens are of considerable historic and scientific value, prepared by self-taught pioneers in ornithological study, and I do not wish to disparage their contributions. I would like to suggest, however, that some consideration be given to training people with an interest

in learning taxidermy and actually mastering these techniques sufficiently so that good local museums would stimulate the interest of school children and others in learning more about wildlife and conservation. We have to look in this direction to the next generation because there is no use pretending that we can influence or persuade poor farmers who have been trying to scratch a living off the land for 30 years that they would be well advised to become interested in birds and to spare the trees, and this sort of thing. Of course, as has already been pointed out, the fewer there are in the next generation the better.

BUECHNER. Before we go on I would like to take a few minutes to let Lee Talbot explain what is developing in the International Biological Program which may be relevant to plans being formulated at this conference.

TALBOT. Most of you gentlemen know about the the International Biological Program (or the IBP). As a very brief recapitulation, the IBP is to be a worldwide ecological study, a worldwide plan of research on the biological basis of productivity and human welfare. It is aimed at learning more about where man fits in the ecosystem that he is now dominating and changing. This program stems from a realization that many of us think is coming very late: that with the increasing human population, one of our greatest problems is not learning more about the stars but, rather, learning more about how to make our terrestrial environment produce enough food and other products to support us; and the further realization that we actually know relatively little about this critical problem. Many of the comments made this morning have emphasized the primitive state of our knowledge—or at least our practice of food production and other types of production in the tropics and elsewhere.

This program is somewhat of a biological parallel to the International Geophysical Year that was considered so successful. The aim is to have coordinated studies into various aspects of ecology, emphasizing biological productivity, carried out by national IBP programs throughout the world. At present the program is in what is termed stage I, which is the phase of design and planning. Stage II will start about the middle of next year and will consist of a 5-year action program.

The general organization of this program sounds impressive, but people want to know specifically what is involved. There is an international body organized under the International Council of Scientific Unions

which has the function of providing the overall coordination. The research program is divided into seven sections to provide a framework for its work. One of these sections is the conservation section, which I shall mention shortly. Within each country that chooses to participate, national IBP committees are established and the actual work through research programs, etc., is to be carried out by these national programs under the national committees. Before the national committees are established, in many cases during this formative period, the first stage is to have a national correspondent who gets in touch with the international headquarters to get assistance on how to set up the program.

The conservation section would have the most application, I believe, to the subjects that have been discussed at this conference. One of the objectives of the conservation section is to put conservation on a scientific basis. One of the great needs that was brought out in some of the discussions this morning was to put conservation on a practical, accepted basis within each country, rather than on an emotional one, or on a basis which is not considered important by the people who happen to implement it—particularly by the politicians, the government administrators, and the landowners.

One of the aspects of conservation that is of primary concern to the IBP in this connection is to assure that there are sufficient examples of natural habitats preserved to allow for the needs of studies at present and in the future. In effect this amounts to assuring that there are ecological reference points in “natural laboratories” for present and future needs of science—aimed basically at human welfare. The emphasis that has been developing this morning on the need to preserve habitats if we are going to preserve birds or any other aspect of the environment fits directly into this conservation objective of the IBP. Therefore, within the terms of reference of the discussion this morning the IBP offers us an opportunity in perhaps three main ways: first, it can provide a framework or structure within which national programs in conservation in Latin America can be established. Second, it offers a possibility to obtain international recognition and in some cases substantial international support for these programs. Third, it offers a possibility to focus both national and international attention on the conservation problems and programs involved.

Again this sounds impressive, but in practical terms, what can we do? Well, first, in a few Latin American countries there are national correspondents for the

IBP. Where these exist we can contact them to find out what they are doing or thinking in terms of conservation and of conservation work. In most cases, judging by the recent IBP General Assembly in Paris, there is so far relatively little thinking in this part of the world in conservation. We can then, in cooperation with these individuals, work out a conservation program, or find out who should be contacted to accomplish this. This, therefore, is an opportunity for those who are assembled in this room to generate a conservation program within the IBP structure in the countries where any such structure already exists. In most of the countries involved, however, there is not yet a national committee. Therefore, there is an opportunity and, I would think, an obligation for those of us here, or the appropriate officials that we can contact, to become IBP correspondents. After this meeting if anyone would like addresses or further information they could contact Dr. Graham, Dr. Buechner, or myself and we would be glad to help on this. The IBP provides a potential for both national and international programs of support of conservation. The practical support may come from individual governments, foundations, bilateral programs, FAO, UNESCO, or other international organizations that are becoming more and more concerned with conservation.

As my wife mentioned at the coffee break much of what was said this morning and at other times in this meeting sounds much like a rebroadcast of the Conference on Conservation of Nature and Natural Resources in Tropical Southeast Asia held last fall in Bangkok. It is very striking how parallel many, and perhaps most, of the problems are between Latin America and Southeast Asia. One of these problems is the lack of communication between people within a country or people in adjacent countries, and the lack of realization of the opportunities that now exist in the international field for support in the general field of conservation.

I would like to present two more specific points. Dr. Lehmann, among others, mentioned the importance of national parks and equivalent reserves. There is now a "United Nations World List of National Parks and Equivalent Reserves" which has been compiled by the International Commission on National Parks of the International Union for Conservation of Nature and Natural Resources (IUCN). This list will be published within the next several months. It is worldwide and it includes parks and equivalent reserves from about

134 countries, along with a series of criteria for judging the effectiveness of parks and reserves. This list is merely a document, but it can be a very useful document that one can take to his government and say, "This country and this country and this country have so many parks and reserves and we don't have any. What are we going to do about this?" This prestige aspect is extremely effective, as has been indicated by some of the remarks here.

This U.N. list is one of the projects that has been completed by the IUCN. The IUCN can offer another form or opportunity for international cooperation, focus of attention, or support which earlier discussions here have indicated was needed in Latin American conservation. If anyone would like additional information on the International Union and how it might be able to assist, I would refer them to Dr. Graham, Dr. Buechner, or myself.

BUECHNER. I should point out that Dr. Talbot is employed by the Smithsonian Institution in the Office of Ecology, and is on assignment with Max Nicholson of the central committee of the IBP to help develop the program in terrestrial conservation.

FOSBERG. I have two not very closely related suggestions, but I will make them both while I am on my feet, and then subside. In connection with our suggestions to AID—I have been paying considerable attention lately to the life-zone system proposed by Dr. Holdridge, and it seems quite clear that this does fairly differentiate lands in tropical countries into those that are suitable for certain types of agriculture, those considered suitable mainly for grazing, and those that are much better adapted for forestry and other purposes. Now, there exist maps based on this system for most or all of the Central American countries. This information is available and while the details may not be all worked out, still I should think that the attention of AID should be directed to this system as a rough basis for where they should perhaps promote development schemes and where they should not, and as to the kinds of development that are suitable for these areas. I am sure that AID people will listen a lot more readily to suggestions made on a practical basis, where there is a map on which they can see what is being talked about, and I would suggest some consideration of this in any memorandum that we direct to AID.

The other suggestion is on an entirely different level. The proceedings of this meeting will undoubtedly be published in some way and distributed to at least a

few people, probably I think to the people who know most about the subject already. Probably they will not reach the ones it is most urgent we influence: the general public in the countries we are talking about. I do not know if this is a practical idea, but I should think that we might contact the editorial divisions of the *Reader's Digest*. This is the magazine with the most tremendous circulation of any in the world. It has a special Latin American edition in Spanish. If they could be induced to go over the proceedings of this conference and pick out things that should be called to the attention of the people in these countries and publish them as an experiment in one of their condensations, especially in their Latin American editions, it might produce a hundred times as much effect as simply distributing this volume of proceedings to a few hundred libraries and biologists, who, of course, can make good use of it. This would not detract in any way from its value as a scientific document, but would spread its influence over a tremendous segment of the intellectual population, at least, both of the United States and of Latin America, as well as of other parts of the world.

HOLDRIDGE. You all know my tendency toward the use of numbers in ecology. I would like to suggest the use of the magic number three as a propaganda tool for the conservation movement. The number would comprise three types of conservation: One for our grandchildren and the long-term future, the establishment of natural preserves; one for this year and the next, the reservation of national parks for weekend trips and vacations; and, lastly, one for today, tomorrow, and the next day, the enlargement of city parks and green belts into which every urban man can walk without expense.

As a goal each one of the three should comprise 1 percent of the national territory. The 1 percent in preserves, if located to adequately encompass environmental diversity, should be sufficient to save all species and subspecies except possibly some of the large-bodied ones. The 1 percent in national parks, and the last near or in the cities, should be adequate to shelter and sustain the migratory birds.

SPRUNT. I have two much less far-reaching suggestions than some of those that have been given. One we have been discussing at some length—the danger of the caged bird traffic and live animal trapping. One of the difficulties in controlling this is the confused situation of protective laws in the countries that are involved. We are able to control this traffic from the

U.S. end because we are able to prohibit the importation of animals that are protected in the country of origin. I have been trying for 5 years to find out what Latin American countries protect flamingos and I have not done it yet. It is a very difficult problem. I wonder if it would be possible to have either this body or perhaps the Pan American section of the International Council for Bird Protection prepare and promulgate a model law very much as was done by the Audubon Society here in the United States 50 years ago, where a minimum standard of protection for wildlife species is drawn and adapted to each of the countries involved. At least it would provide a starting point. Mexico has a very good law. Perhaps we could start with that one. At least you would have a framework so that law enforcement agencies in the various countries would be familiar with the laws in other countries and would also show control on the customs level here in the United States. Actually, I think that the live bird and animal traffic is only involved with three or four “consumer” countries in the world. Probably the United States, Great Britain, Germany, and Holland are the ones that are most involved. If we could, at an international level, get similar laws to that existing in the United States, Great Britain, Holland, and Germany, and we could close it off at the consumer end, I think we could stop the live animal traffic pretty much in its tracks. I think that you will have to start by simplifying the protective laws in Latin America before you can get anywhere with such a program.

Now, the other suggestion has to do with getting conservation over to the people in Latin America. Dr. Ibarra and others have mentioned particularly the use of mass media such as magazines and newspapers. I wonder if it would be possible to have a foundation here in the United States prepare through the use of writer-artist combination, or something of this sort, a nature column to be widely distributed to newspapers and possibly magazines throughout Central and northern Latin America. I am sure that this would be used, for newspapers all over the world use canned material. If it were prepared properly and given to people free, I am sure that it would be used and might be a method of getting conservation messages across. It could be expanded for radio, television, and movies if money were available. Perhaps the newspaper column could be done quickly and rather reasonably.

BUCHINGER. I would like to make several comments. One is that if this meeting contemplates sending a recommendation suggesting the improvement of some

practices to AID, it might be quite a good idea also to send the same to the Alliance for Progress, the International Development Bank, and the Peace Corps, as they are all involved in or sponsor enterprises which have certain effects on the ecosystem. Another comment is that it would also be advisable to include in the group which is making the recommendations somebody who speaks Spanish. I do hope that the recommendations are going to be published also in Spanish and in this case the translation is most important; it has to be made by somebody who has ecological knowledge. So I hope Dr. Holdridge is going to stay here long enough to help; if not, I would suggest that Mr. Tasaico should be asked. He is also working at the Pan American Union (Natural Resources Unit), has his degree in forestry, and is a Peruvian who has worked in the Dominican Republic. I must insist that it is very important how the recommendations are presented.

My third suggestion refers to Dr. Howell's comment, and excuse me if I have to beat my own drum, but Dr. Howell was speaking about the importance of getting private people interested in projects. I would like to call to his attention that the Nature Conservancy has a Latin American Desk, and our work is exactly following on this line. On the first day of this meeting, as you recall, there were two groups who thought that they disagreed because one stressed the advantages of having privately owned and protected preserves and the other was speaking about the value of a national park system. The Nature Conservancy type of organization feels that both the private and governmental efforts are important and therefore encourages both. I would call your attention to our pamphlets both in Spanish and in English, none of which are copyrighted. In some countries local newspapers reprint them because the local authorities develop a patriotic pride in the land-saving movement. In addition to national pride is personal pride. Sometimes there is even too much of it. One of our projects in Argentina was lost because a family whom we told could have a natural area with a stand of palms as a living monument for their grandfather, decided they did not want to buy the land as the price was too low. They wanted a bigger and costlier preserve.

EISENMANN. A few more or less disconnected points: as to resolutions, people of Latin American experience ought to look at them no matter who drafts them. I hope that the committee, before promulgating resolutions, will send them around. They need not wait an indefinite time for reply. Those who do not reply can

be ignored, but give them a few weeks to comment. That is point 1. Point 2 relates to a matter mentioned by Dr. Ripley last night. I think I understood him to say that he had in contemplation holding other meetings of this sort, perhaps once a year. I would suggest that if that is in view, it might be well to have some of these meetings in Latin America. There we could have conservation publicity; many other people would attend and it would be more educational. I do not want to make any suggestion for a place for the next meeting. There are places like Mexico which are nearby. In Panama the Smithsonian Institution has an office and station, and it would be easier for other Latin Americans to reach. Point 3 involves a matter of emphasis. Most of us here are interested in birds. We all realize that we can not have the variety of birds we wish to preserve without preserving the necessary variety of habitats. That is why, as I mentioned yesterday, birds, because of the strong emotional appeal they have for many people, serve an especially valuable function in the broader conservation picture. Let us remember, too, to paraphrase what was said recently by one of my colleagues, Dr. Dean Amadon, that birds are sensitive reflectors of conditions in the environment. Formerly, a canary was taken down into mines to test whether the air was safe for men. Today, a general deterioration of environment for birds foreshadows a deterioration for man.

SWIFT. There have been some very excellent statements made by us here and in nearly every case some reference has been made to forest destruction. Yet in pursuing the discussions hardly anyone mentioned forest management. There was a frequent reference to reserves and parks, and this has caused me to suggest that forest reserves and management ought to be brought into the picture. Now, I speak without knowledge of the forestry situation in Latin America, but I do have some knowledge of it here in the United States, having spent some 35 years in the U.S. Forest Service. A good part of that time was devoted to heading up the Division of Wildlife Management.

It is true that foresters historically have not been as interested in noneconomic wildlife as most of us would like. But foresters are changing, and changing rapidly, and I think quite to the good. Within the United States, for example, the forest system, Federal and State, preceded the other types of land preserves. And that was a good thing because these lands were given a reserve status, recognition, and eventually good administration. Some of our better more-restricted pre-

serves, such as wilderness areas, are part of the national forests. So the forest reserve was the forerunner to some of the things we are talking about.

Now, the other thing is that the foresters in this country have also pioneered in the protecting of some of the species that we worry about. The California condor, for example. This species is down to perhaps 40 individuals. In the very beginning, with the assistance of outside agencies such as the Audubon Society, the foresters were the ones who moved to set up a reserve for protecting this rare and vanishing species.

The State and Federal foresters at the present time are doing a really outstanding job in managing breeding habitats for the Kirtland's warbler and deserve a great deal of credit. In Puerto Rico, the Puerto Rican parrot, now 200 or fewer individuals, is perhaps surviving because it has found sanctuary in the Caribbean National Forest.

In view of these points, I believe the resolution group should look into the means of strengthening a national forest system in Latin America. There is at the present time an International Commission of Forestry operating in Latin America under the auspices of FAO. Also within this commission there is a committee whose interest is directed to conservation matters, wildlife, and parks.

IBARRA. I know of three ways. First, those countries that do not have protection laws should legislate to cover such situations. At this point I want to congratulate those nations that have recently legislated on the subject, particularly Mexico and Costa Rica.

Second, I should mention the need of publications such as the one I am publishing in my country entitled *Historia Natural y Pro Natura*, which contains conservation articles translated into Spanish. These articles are written about popular subjects and their translations are of much interest to the people of Latin American countries. My magazine has an edition of 2,000 copies, and I intend to find a person or institution to sponsor an increase up to 10,000 copies in the near future.

Third, a point about nonnative birds. In Central America certain hunting clubs want to import such birds from Europe or Africa for the sole purpose of hunting them. We must avoid this, because it means an unnatural aggression and a threat to our avifauna and its habitat.

FOSBERG. One comment to follow up Lloyd Swift's discussion about forestry. One of the problems with foresters, as I have observed them in Latin America,

is that they seldom go out and look at the trees that are growing there. They look at the map and say "here is where we should have some forest. Let's clear away this brush and plant pine and eucalyptus." This does not help very much to preserve birds. I think we may do well to carry on a campaign of enlightenment among the foresters working in Latin America and perhaps send some of a different kind down there as advisers, some that do know there are probably 20,000 species of trees in Latin America, many of which might have some future interest. Perhaps they could suggest that some forest management to preserve the existing combinations and associations of trees would be as worthwhile as trying to train temperate-zone pines and Australian eucalyptus to do what they want them to in Latin America.

BUECHNER. I would like to call upon William Warner of the Office of International Affairs, Smithsonian Institution, to speak on how the Smithsonian, or other organizations, might help to contribute toward solving some of these problems of conservation in Latin America.

WARNER. I feel especially obliged to give you a view of some of the things of interest to you that the Smithsonian is doing and can do, and some of the things that we cannot, after Dr. Phelps made those well chosen remarks about the Smithsonian sending visitors abroad with resounding letters of introduction. I visited Venezuela with another member of the administrative staff of the Smithsonian about a year ago, and I feel that perhaps all we succeeded in accomplishing was what our people in the Alliance for Progress call "a revolution of expectations," expectations which we have not been able to follow through on very fully. Therefore, I would like to tell you some things we are doing and hope to do in the future. On the matter that Dr. Phelps brought up, of international cooperation in conservation of natural areas, we, of course, want to do all we can in this area. Some small steps that we are taking now include adding the Smithsonian's voice to that of the Department of Interior's in conservation problems in this country. The voice we add stresses the scientific value of potential natural areas or reserves; the Department, which of course has many other factors to consider in setting aside natural areas, seems to welcome our supporting voice on scientific uses.

Somewhat more difficult, of course, is the situation abroad. But again, we do try to help in the determination of scientifically valuable areas or threatened habi-

tats. What we cannot do in international conservation is to consider direct contributions to the acquisition of new land areas. This is because our governing body, the Smithsonian's Board of Regents, and our congressional committees feel very strongly about consolidating what we have here in the United States and not getting overextended abroad. Stated another way, we are now having too many problems establishing a reserve and biological field station 40 miles away on the shores of the Chesapeake to consider doing the same abroad. But, as I say, we do want to continue to lend a supporting voice wherever it is wanted, here or abroad, about scientific uses of natural reserves, parks, and equivalent areas.

On the AID front, which many of you have spoken about today, I would almost like to go off the record, as they say at the other end of the Mall, and tell you that while I think that many of the resolutions that you are going to formulate and pass on to AID are well conceived, you will nevertheless find that it is very difficult to get real support or funding from AID for much of what you want to do. Beyond resolutions, we need to work together in the task of persuading AID to support the kind of basic research on ecosystems in which we are all so interested. Dr. Ripley wants very much to promote this; he visualizes an almost automatic relationship whereby every time our foreign-aid administrators plan a new road through undisturbed tropical forests or a new resettlement project along the eastern slope of the Andes, they would come to the Smithsonian or other basic research institutions for before-and-after ecological surveys, which would be valuable to AID and to science.

But as Dr. Philip Humphrey, here present, can tell you, since he and I have had the occasion to meet recently with AID administrators for Latin America, at the highest level, there is a difficult task of persuasion yet to be done. I can say that AID is not at this time prepared to invest funds to stimulate the development of national parks or similar reserves, nor are they ready to support ecological research in the way I have just mentioned.

We believe that there are two ways to convince AID to help us in some of the things we are all interested in here. First, you have to pick and choose very carefully such basic research projects as are so intimately connected with economic development or of the saving of valuable resources that it will be almost a necessity to our foreign-aid administrators to support them—those where the need is so clear that they almost cannot ig-

nore it. Dr. Buechner and I have been working in this connection with the very disastrous problems that you all know are now taking place with Peru's marine resources. The shocking decline of guanay birds, from 18 million a year ago to 2 or 3 million now, the serious losses in anchovy fishes through overfishing—these are problem areas which need much more ecologically oriented basic research. This is perhaps a good test case because one of the proudest accomplishments of AID in Latin America has been the development of the fishmeal industry in Peru and the emergence of Peru as a major fishing nation of the world, as number one, in fact, in terms of either tonnage or value of the catch. So here is something vitally connected with valuable resources. This is the kind of basic research in support of conservation measures that may stand a chance for AID assistance.

Second, we are working on the Amazon basin. Our foreign aid administrators for many years have thought about the necessity of total ecological studies and resource surveys of the Amazon basin as a sound first step in planning for development. There have been some false starts and there have been some political problems in launching Amazon basin studies, mainly because many think the only way to begin is to create a great and ambitious Amazonian Institute *de novo*. Meanwhile, we at the Smithsonian believe it is best to go ahead working with existing Brazilian institutions, some of which are doing excellent work in the basic ecology of the Amazon, and we hope that when policy makers and statesmen come around to recognizing the need to increase these studies we will be able to point to these institutions, show what a good start they have made, and thus be able to influence orderly and sensible planning for the Amazon basin.

Finally, as a practical suggestion, we have found that no matter what you are talking about in basic research or in conservation measures, AID will listen more attentively or be more interested in any project that has a "human resource" or training potential in it.

Let's pass to some other points, to some of the educational measures that you talked about. We feel that in the field of museum education there are perhaps some promising developments on the horizon. This year the House of Representatives has already passed and the Senate is now considering a piece of legislation called the U.S. National Museum Act. This Act requires that the Director of the U.S. National Museum, which is of course a part of the Smithsonian, cooperate in developing new museum exhibit techniques and pro-

professional exchanges with individual museums or professional associations, "both here and abroad." Our purpose in introducing this bill was to give us a base of authority for developing exchanges of curators or museum professionals on our own, without having to beg from foundations or from federal agencies for whatever help they can give to this neglected field. We hope in time therefore to have funds for this kind of activity. Dr. Ripley is intensely interested in the potential of museums for education in developing nations. We are trying to determine the dividing line between what can best be taught in the classroom and what can best be taught in a museum. This is really a pioneer research problem, because although people talk much about cognitive studies, or about the "open-end education" that museums afford, there really hasn't been much work or much experimentation in testing the full potential museums may have for education in developing societies. I myself feel that the potential is great in Latin America, because I have seen the educational programs of the Departmental Museum of Cali in Colombia which our good friend Carlos Lehmann has built up and what they do for school children. I have also seen, although not for many years, the Museo de Historia Natural in Guatemala City, developed by Professor Jorge Ibarra, here present. And so whatever else our museum experts may decide about educational techniques, I believe that we all agree that there is one message that a museum can get across very easily, and that is an appreciation among young people for the natural resources, the wildlife—let's say for the total natural history of their country. I think we all agree that this can be done, and I know the Smithsonian will look forward in the future, with the passage of the Museum Act, to actually doing something in the way of experimental exhibits that could be sent abroad to help conservation education or natural history teaching.

I think also that a vast and yet untapped source of assistance for some of the things we all want to do is the Peace Corps, an organization with which I was associated during its first 2½ years. In the beginning the Peace Corps had a somewhat ambiguous attitude

toward conservation. I think Dr. Vogt, who is with us today, can tell you that some of us tried to introduce some of his conservation pamphlets in the training courses for Peace Corps volunteers going to Latin America. This was a small start. In the beginning days of the Peace Corps it was rather hard to convince anyone that such activities as ecological surveys using Peace Corps volunteers as assistants should form any part of the Peace Corps program. Such research projects seemed a little remote. The Peace Corps in its first year wanted very much to get on with the most "urgent developmental and educational tasks." They wanted volunteers to leave monuments behind. Now in its fifth year, I do believe the Peace Corps is getting a little more sophisticated and there are some very promising signs. Already, in fact, we have gotten an affirmative reception to the idea of using Peace Corps volunteers as observers on oceanographic ships or fishing vessels off Peru, to identify and count the guano-producing species and to observe their feeding habits far out at sea. But I believe that we should go on from there to the possibility of using Peace Corps volunteers and their Latin American counterparts in conservation education. They could be used at many levels; as "circuit riders" in primary schools, helping teachers to develop better natural history teaching materials; in secondary schools, giving more sophisticated courses on natural resources; and in adult education through radio, television, or extension programs. This can be done and I believe there are encouraging signs that such Peace Corps programs would be welcome in many southern hemisphere republics. I hope it will be done.

This is very briefly some of the things we are doing on the international front.

BUECHNER. I think it is evident from this last hour and a half that there is no dearth of ideas. There are many avenues of approach. I think from here on it is up to the individuals in this room to help develop a program that will eventually achieve some of these objectives we have in mind.

This concludes the conference.

Suggestions Emanating from the Conference on Avifauna of Northern Latin America

The following suggestions represent a synthesis of ideas of participants of the conference in response to the discussions and an initial list of suggestions developed by John W. Aldrich.

Natural Areas

The establishment of national systems of natural areas in both public and private ownership is the key to avifauna conservation in Latin America. To establish such systems of natural areas, the conferees agreed that:

1. Ecosystems to be conserved in their natural state should be identified and described as a basis for management and legislative action.
2. The highest priority should be given to forest ecosystems through national forest policies aimed at conserving the remaining natural forest areas. Much of Latin American forestry is oriented around pine plantations, which should be encouraged as a deterrent to further destruction of natural forests.
3. The establishment of national parks and wildlife refuges should be encouraged as emergency measures in areas where important natural habitats are in danger of being lost entirely.
4. Emphasis is required on areas of mature humid forest, since it harbors the largest number of non-adaptable species of plants and animals that would become extirpated with the elimination of the forest vegetation.
5. In support of conservation measures, appeals should be made to the pride and patriotism of the people, landowners, and government officials, with emphasis on their feeling for the beauty of the landscape and the uniqueness of their fauna and flora, the need for forest preservation to maintain soil and water, and the various economic benefits to be derived from conservation practices.

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Legislation

With due recognition of the difficulties of enforcing legislation in Latin American countries, the conferees recognize the importance of legislation to establish public policy.

1. The ratification of the existing conservation convention entitled "Convention on Nature and Wild Life Preservation in the Western Hemisphere" was urged, together with the suggestion that treaties for bird protection similar to those among Canada, the United States, and Mexico should be extended to other American nations.
2. Collaboration should be encouraged between nations to reduce violation of conservation laws by apprehending violators with illegally taken wildlife at border crossings.
3. Legislation should be enacted to forbid the killing of wild birds, or the taking or destruction of their nests, eggs, or young, except for scientific or educational purposes, or in the case of game birds, under careful regulations that will insure reproduction, or in the case of the species found detrimental, only after careful study and specific regulation.
4. Legislation should be enacted to stringently protect those species in danger of extinction or local extirpation, or of special esthetic, patriotic, economic, or touristic interest.
5. Information on laws and enforcement methods should be exchanged more effectively among the American countries.
6. The U.S. Department of the Interior should be encouraged to cooperate with Mexico and other Latin American countries in conservation law enforcement and other conservation management practices.

Research

Programs of research not only increase knowledge but also focus public attention on the conservation of

avifauna through this demonstration of active concern and interest.

1. International bird-banding programs should be organized to stimulate interest and focus attention on the need for protecting migratory birds, as well as to obtain additional information on bird migration and population biology.

2. Since conclusive information is lacking on the changing abundance of most of approximately 400 species of birds that nest in North America for the winter, governmental and conservation agencies of the United States and Canada should be urged to support studies of avian species within their respective countries to provide a quantitative basis for determining changes in levels of populations resulting from various causes, including those in the wintering habitats of Latin America.

Education

Education holds the greatest promise for altering the conceptual environment of Latin America peoples toward an appreciation for wild animals and their habitats.

1. Education designed to alter the tradition of keeping wild birds in cages and exporting these to other countries should be fostered, with the substitution of less damaging natural history interests.

2. Short-term international fellowships for "on the ground" training of technicians in censusing, banding, and other wildlife management techniques should be promoted.

3. The department of scientific affairs (unit of education and research) of the Pan-American Union should be encouraged in their current preparation of educational materials on conservation.

Communication

The communication of sound knowledge to society as an informal educational process is perhaps the most powerful force to firmly establish effective conservation programs.

1. The success of various countries in obtaining economic return and educational benefits from wildlife refuges and state and national parks through tourism and recreation should be publicized.

2. The results of studies of the effect of pesticides on wildlife should be disseminated as widely as possible, and it should be suggested to public health agencies that they evaluate the effects of pesticides on ecosystems in Latin America.

3. Simple and interesting stories about animals and particular birds, capitalizing on public interest in national birds, should be prepared in Spanish, and the *Reader's Digest* should be encouraged to publish Spanish extracts from English language books on conservation.

4. Conservation activities and accomplishments, both by governmental and private organizations, should be publicized in Latin American countries.

5. "Guides to bird watching" for Latin American countries should be prepared.

6. Attention should be focused on the desirability of preserving particular areas to conserve avifauna and foster increased tourism by publicizing their value for bird watching.

7. Outstanding examples of conservation successes should be publicized to stimulate similar action in needy areas.

8. Since conservation consciousness frequently begins with interest in identifying birds, conservation organizations should be urged to help finance guides to the identification of Latin American birds.

Management

The management of avifauna is accomplished through the enforcement of legislation, the control of population levels through harvesting or protection, and the manipulation of the vegetation of the avian habitat.

1. Secretary S. Dillon Ripley suggested the following resolutions to the conference, to which the conferees responded affirmatively:

"Resolve that this conference on the Avifauna of Central and Northern Latin America, held at the Smithsonian Institution in Washington, D.C., 13-15 April 1966, urge AID (U.S. Agency for International Development) to insert a special provision or clause in any agreement with a Latin American nation or agency in respect to the construction of any dam or hydroelectric facility that provisions be made for preserving and maintaining forest watersheds by providing forest guards, including their transportation, in watershed areas associated with such construction. These provisions shall include the negotiation of funds

to be provided either by AID or by the nation concerned."

2. It was recommended by Lester L. Short, Jr., and approved by the conferees that:

"Introduction of exotic birds, especially from the Old World, can ultimately bring about the extinction of indigenous birds that are unable to compete successfully in direct competition with the exotics. Protection of indigenous faunas from undue competition from exotic forms is especially important in view of the wholesale ecological changes already affecting native

neotropical species as a result of increased human activities in Latin America."

3. In the presently occupied agricultural areas more intensive use and greater productivity should be fostered to relieve the pressure to convert wild lands to agriculture.

4. The cutting of trees along watercourses, lakes, steep slopes, and roadsides in rural areas should be regulated to encourage the maintenance of trees in such localities.

Appendix

Recent Progress (1969) on Legislation to Control the Trade in Threatened Species

The conference has emphasized the role of the animal trade in contributing to the reduction of the numbers of various species of birds and has shown that the trade threatens some of them with extinction.

The animal trade, like any other one, involves a supply and demand. Most conservationists have concluded that control of the demand is the only effective way to regulate this trade at this time.

This conclusion is based on study of the supply end of the trade and of the difficulties encountered in attempts to regulate exploitation of the supply. In most countries the conservationist concerned with threatened species is faced with a family of associated problems.

First is lack of basic knowledge on the fish and wildlife involved. Adequate knowledge of the distribution, status, and ecology of threatened species is the exception rather than the rule.

Second is the lack of adequate legislation on endangered species, or governmental support where such legislation exists. In most countries protection of threatened species receives a very low priority compared with urgent problems of social and economic development.

Third is the problem of enforcement, even where adequate laws exist on the books. Adequate training of customs and other enforcement agents is an associated problem. Few such officers are able to identify a threatened species when they see it.

There is great variation from one country to another in legislative protection given to threatened species. An animal may be totally protected in one country but be unprotected in the adjacent country, which then may serve as a legal outlet for specimens illegally or unwittingly obtained from its neighbor.

Given the magnitude of these problems at the supply end of the trade, representatives from many coun-

tries have concluded that at this time the only effective approach is at the demand end.

The conference brought out the key role of the United States in much of this animal trade. In 1967 legislation was introduced in the Congress of the United States aimed at controlling this aspect of the trade. Several bills were introduced in the House of Representatives and the Senate in the 90th Congress during 1967 and 1968. These bills were reported out of committee in the House as H.R. 11618, introduced by Congressman Lennon, and in the Senate as S. 2984, introduced by Senator Yarborough. The legislation was passed in the House and narrowly failed in the Senate. Subsequently early in 1969, at the start of the 91st Congress, a series of similar bills was introduced in the House and Senate.

Although they differ in some details, all of these bills address themselves in general to control of the import, export, and transshipment of threatened species of wildlife. The U.S. Department of the Interior is to be the executing agency and under the terms of the bills, the Secretary of the Interior has the discretion to identify threatened species in consultation with appropriate authorities. The International Union for Conservation of Nature and Natural Resources (IUCN) is specified as the major international authority, and the IUCN Red Book on Threatened Bird Species is specified as the authoritative compilation of these data.

Although the United States is in a central position in the animal trade in the Western Hemisphere, it is recognized that to be truly effective, control over the trade in wild species must be international. As a result, and in accordance with action taken at the IUCN General Assembly in 1966 in Lucerne, Switzerland, the International Commission on Legislation of the IUCN

developed a draft international convention on the import, export, and transshipment of threatened species. After various modifications the convention was issued in draft form in 1967 and was submitted to the 68 nations which were member governments or in which there were member organizations of the IUCN. The main thrust of this convention is that the signatory nations agreed not to import, export, or transship threatened species of wildlife. As in the U.S. national legislation, there are exceptions for scientific and con-

servations purposes and the primary authority is the IUCN Survival Service Commission and its Red Book compilations. Favorable replies have been received by the IUCN from many of the nations and various amendments have been suggested to the original draft. As soon as sufficient replies have been received, the IUCN plans to amend the convention accordingly and seek international ratification.

LEE M. TALBOT
27 February 1969

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