

Fire and Birds in the Mountains of Southern Arizona

JOE T. MARSHALL, JR.
The University of Arizona

AS BIOLOGISTS whose interest in science stems from our love of nature and our desire to understand her workings through evolution, we want some native vegetation and animals preserved. Some of us go further and dare to suggest that mankind is doomed if he continues relentlessly to remove all the natural vegetation and animal life of the earth through "development and progress," by which he increases carbon dioxide in the atmosphere, loses his source of a steady water supply, destroys the soil, and thus drastically reduces the means of providing food for his outrageously expanding population. He comforts himself in a childlike faith that the physical scientists will invent new sources of food, fresh water, and fuel—so much easier obtained by natural means when not overdone. Let me quote from E. B. Worthington's "The wise use of wild lands, a message from Africa" (Nature conservation in western Malaysia, 1961. Kuala Lumpur, pp. 133-135):

The thesis of this note is a simple one: that millenia of evolution of plants and animals in each of the biogeographical regions, as originally defined by Alfred Russell Wallace, have produced ecological systems which have very high efficiency in converting the energy of sunlight into plants and animals. Indeed the efficiency is such and the bulk of the plant and animal matter produced is so great that rarely can it be matched by human beings with all their ingenuity of introducing exotic organisms and creating systems of monoculture. If this thesis be accepted, then the normal

JOE T. MARSHALL, JR.

process of "development" in which the wild animals are shot or chased away, the trees felled, the shrubs and herb layers are burned, the soil torn up and the complex wild eco-systems are replaced by simple tame systems, must lose something of value. Total biological production is reduced in favour of a slower energy exchange, a smaller potential annual crop.

Even we "civilized" folk abuse vegetation when we attempt, in the mountains of southern Arizona, to preserve the natural values of water, forage, lumber, wildlife, and recreation without regard for Nature's processes which could permanently maintain these values. I propose in this paper to show that by excluding natural fires we endanger the very thing we wish to conserve; we convert potentially grassy park-like forests into dangerous tinderboxes of fallen branches and dense trees. I fell into this view quite by accident when I was comparing wild bird populations in the mountains of southern Arizona with those just across the International Boundary in Sonora and Chihuahua—a study carried on in the summers of 1951-1954 (for which I thank the John Simon Guggenheim Memorial Foundation and the Western Foundation for Vertebrate Zoology). These were birds nesting at middle altitudes of around 6000 feet, in pine-oak woodland; the vegetation is described, and the birds enumerated in Pacific Coast Avifauna no. 32, 1957: 1-125; and Condor 58, 1958: 81-97. Suggestions on the relation of fire to openness of the woods is found on pages 36-37, and on the effect of openness on the numbers of birds on page 49 and table 3 of the first citation, published by the Cooper Ornithological Society.

These are the results of the study which pertain to our present conference on fire ecology. The same trees dominate these woodlands on both sides of the border: Apache Pine *Pinus engelmanni*, Chihuahua Pine *Pinus leiophylla*, Arizona Oak *Quercus arizonica*, Emory Oak *Quercus emoryi*, and Silver-leaf Oak *Quercus hypoleucoides*. (To the south, Alligator Juniper *Juniperus deappeana*, is an occasional member of the flora, whereas in Arizona it is extremely numerous). Nevertheless, the appearance of these woods is strikingly different north and south of the International Boundary. To the south, the splendid clear-trunked trees stand apart over a park of grass (Figs. 1-3). In Arizona they compose a stunted growth, choked with fallen branches, young trees, and junipers; there is practically no grass,

Fig. 3. Sierra San José in Sonora, 5 miles south of Naco, Arizona; summer, 1958, showing grass and openness of the Ponderosa Pine forest in an area not protected from fire.



and one can hardly force his way through the tangle (Figs. 4, 5). It was a great surprise to find at these elevations in Mexico, birds which are restricted to open lowlands in Arizona, such as the Sparrow Hawk, Roadrunner, Screech Owl, Cassin's Kingbird, Curve-billed Thrasher, and Brown Towhee. These and the Harlequin Quail, Common Nighthawk, Purple Martin, Violet-green Swallow, Robin, Western Bluebird, Eastern Bluebird, Mexican Junco, and Chipping Sparrow were more numerous south of the border than in the Arizona mountains, where they are limited to openings such as at Forest Service picnic grounds. A smaller number of species were more numerous in the Arizona mountains; they prefer brush or they tolerate crowded woods: Elf Owl, Ash-throated Flycatcher, Blue-gray Gnatcatcher, Black-throated Gray Warbler, Scott's Oriole, and Rufous-sided Towhee. Most of the birds of this kind of woodland feed either at the ground, on the seeds or insects found in the herb layer, or in the air in the spaces between the trees. Their abundance is enhanced by openness. Why should the change from crowded to open growth take place just about exactly along the International Boundary? Though a few more bluebirds and Chipping Sparrows may be of little concern to you, surely the causes of the kind of vegetation that is hospitable to them is of concern.

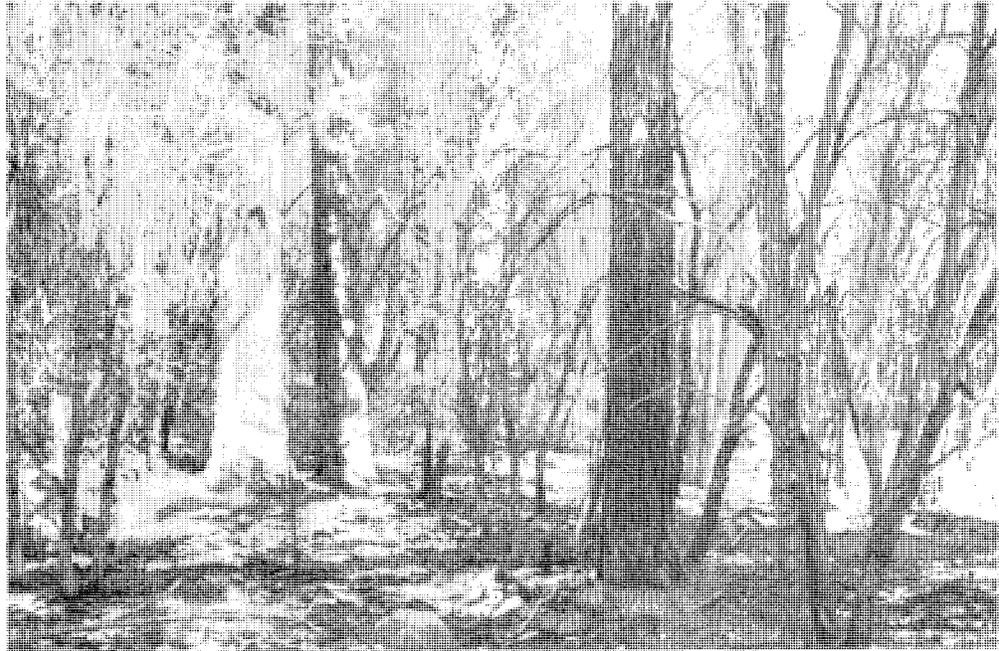


Fig. 4. Dense crowded pine-oak woodland of Chihuahua Pine and Silver-leaf Oak, east slope of Santa Rita Mountains, Arizona at 6000 feet, spring of 1954.

Fig. 5. Same area and time as Fig. 4, showing density even on a south-facing slope. Chihuahua Pine on left, Apache Pine on right.



Is climate responsible for the difference? The area studied extends only 200 miles north and south, yet there is a climatic difference which makes it possible for additional Mexican species of plants, such as *Arbutus xalapensis*, *Quercus endlichiana*, *Quercus durifolia*, and *Pinus durangensis*, to join the woodland growth of the southernmost mountains. To the east, in the San Luis Mountains and east slope of the Sierra Madre Occidental, extreme aridity holds down the stature of trees and promotes the abundance of brushy oak, pinyon, and manzanita thickets. Yet in the main, the marked change-over at the International Boundary suggests the influence of man. He has used the mountain habitat differently on either side of the border. Grazing and lumbering have been similar on both sides—often carried to such an abusive extreme that we must marvel at the ability of the natural plant community to provide such abundance without being destroyed! The community breaks down only where and because greedy man insists on getting every board foot of lumber from a mountain, and having even the last blade of grass converted into beef. But the use of fire has been different on the two sides of the boundary: in the Arizona mountains expert suppression of fire has been carried on for decades; whereas in Sonora and Chihuahua, fires have until recently been allowed to burn unchecked. In both regions, lightning fires occur all during the summer rainy season. In Arizona these either are quickly put out, or they burn the dense woods or forest clear to the ground (Fig. 6). South of the border, until recently, they were not suppressed and they would either kill one tree hit by lightning without affecting its widely spaced neighbors, or they would run through the grass without damaging the tall, clear trunks of the pines and oaks. With enough grass (left over from judicious grazing), such fires can kill the young junipers and crowded seedlings of the other trees, clean off the lower branches from the trunks, and preserve the park-like appearance of the woods.

The self-explained figures will illustrate the above points; some are added from forests above the altitudes of pine-oak woodland, to show that the same principles apply (Figs. 3, 6). Of particular and tragic interest are those showing the start of juniper growth in the Sierra Madre of Chihuahua, following particularly intense grazing and a new passion for fire suppression (Figs. 7, 8). Some of these areas by now are well on their way to becoming Arizona-type woodlands!



Fig. 6. Burn in Ponderosa Pine forest on Saguaro National Monument near Tucson, Arizona. With accumulation of litter through fire-prevention, the forest's fate is to burn to the ground! Spring of 1955, near Summit of Mica Mountain.

Fig. 7. Sierra Madre of northern Chihuahua, pine-oak woodland, spring of 1954, showing start of junipers with increased grazing and fire suppression.





Fig. 8. Same spot and time as Fig. 7, looking in opposite direction from a fence which sets off this grassy pine-oak woods where Alligator Junipers are not yet apparent. Later in summer, wildflowers and luxuriant grasses will abound here.

In Arizona, a return to the natural setting of grass and open stands of trees will be difficult and expensive to achieve. But eventually this will be an economic necessity. It is too late to allow burning to resume. The dead stuff must now be piled, the trees judiciously thinned, and grass reestablished. When that happens, enough grass will have to be left over from grazing to carry fire every few years to maintain the space necessary for grass. The alternative is grim: that of continuing the buildup of litter in our mountain woods and forests until nothing can prevent their burning to the ground. Then all our lumber, watershed, and forage will be lost, at a time when the expanding population needs them most. In other words, the greater our retreat from natural conditions in southern Arizona, the more likely is the total destruction of the forests and woods!



Fig. 1. Jack Pine forest ten years after fire. Note good post fire natural reproduction.
Photo courtesy J. H. Dieterich, U. S. Forest Service.

Fig. 2. Jack Pine forest ten years after fire. Note density of natural Jack Pine reproduction.
Photo courtesy J. H. Dieterich, U. S. Forest Service.

