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In cooperation with The University of Arizona and Northern Arizona University

A Neotropical Migrant Bird's Dilemma—Where to Stop for a Good Meal

To learn how migrating birds determine where to stop and find food, scientists from the U.S. Geological Survey, Northern Arizona University, and The University of Arizona studied the behavior of 28 species of neotropical migrant songbirds—warblers, flycatchers, tanagers, and vireos—along the lower Colorado River from 2001 to 2004. They found that, like interstate travelers greeted by restaurant billboards, songbirds flying over Cibola National Wildlife Refuge, Arizona, relied on the flowering of honey mesquite (Prosopis glandulosa) to detect the availability of insects that they prey on. Understanding where and why migrant birds stop will help land managers better protect key habitats used by these tiny travelers.

For migrant songbirds that breed in the United States or Canada and winter in Central or South America, migration is an energetically demanding part of their annual cycle. Because of their small size, these neotropical migrants cannot carry sufficient reserves to migrate nonstop. Choosing appropriate locations to stop and refuel is important to ensure that birds survive migration and reach their destination in suitable physical condition to breed. Songbirds that feed on insects, such as the Pacific-slope flycatcher (*Empidonax difficilis*) and Wilson's warbler (*Wilsonia pusilla*), prefer locations with an abundance of insects, yet the "cues" birds use to determine food availability as they travel remain largely a mystery.

Scientists know that birds actively choose when and where to stop during migration; however, until recently relatively little was known about how individual birds judge the quality of potential stopover locations. One possibility was that birds determined food availability from the types or condition of local trees. The species of tree and their phenological state (seasonal changes in flowering, leaf flush, fruiting, leaf loss) may present birds with obvious and reliable clues to insect abundance that could be easily assessed at a distance. To test the hypothesis that migrating birds use the species and phenology of trees to determine food availability, U.S. Geological Survey, Northern Arizona University, and University of Arizona researchers repeatedly monitored birds and trees on two 1-kilometer transects at Cibola National Wildlife Refuge, Arizona. The refuge was selected because it contains choice riparian habitat (habitat near a waterway) and is a stopover location for numerous insectivorous neotropical migrant birds, including many critical and sensitive species.

Walking preestablished transects weekly during the spring migration period (March to May), the scientists were able to estimate the abundance of local tree species and follow the phenological progression from bare branches, to buds, to leaves, to flowers, and finally to fruit. At the same time, the scientists estimated bird diversity and abundance and cataloged the habitat preferences of species that they encountered. By comparing when and where birds were found with the availability of each tree species and its corresponding phenological progression, the scientists were able to relate patterns of migration with changes in local tree phenology. To ensure that the changes in


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►These photographs show (top to bottom) the Pacific-slope flycatcher (*Empidonax difficilis*) and the yellow-rumped (*Dendroica coronata*), orange-crowned (*Vermivora celata*), and Wilson's warblers (*Wilsonia pusilla*). The birds are some of the many migratory songbirds that pass through the Cibola National Wildlife Refuge, Arizona, and stop along the Colorado River during their annual treks from winter habitat in Mexico to breeding grounds in the United States and Canada.

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◄Scientists found that migratory songbirds that feed on insects relied on the bright and showy flowers of the honey mesquite tree to determine where best to stop for food. To reach this conclusion, U.S. Geological Survey, Northern Arizona University, and University of Arizona scientists experimentally removed flowers and measured insect abundance on mesquite trees in the Cibola National Wildlife Refuge, Arizona, to determine if flowering affected where birds choose to feed.

Summer tanagers (*Piranga rubra*) were among the 28 species of neotropical songbirds studied by U.S. Geological Survey scientists and their cooperators at Cibola National Wildlife Refuge, Arizona.

phenology really informed the birds about food availability, they recorded the diversity and abundance of insects on each tree species throughout the spring. Scientists also experimentally removed the flowers on trees to determine whether leaves or flowers were ultimately the cue the birds used to select foraging locations.

Data gathered for the five most common tree species—Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), screwbean mesquite (*Prosopis pubescens*), honey mesquite (*Prosopis glandulosa*), and tamarisk (*Tamarix* sp.)—revealed that only the flowering of honey mesquite coincided with the spring peak in diversity and abundance of migrating neotropical songbirds moving through the study area. Migrant birds preferred honey mesquite to all other tree species in the study area. Moreover, they preferred honey mesquite trees with more flowers because these trees harbored more of the insects that they preferred to eat.

The experiment that reduced the number of flowers on trees clearly demonstrated that birds showed a preference for honey mesquite with more flowers, independent of leaf phenology. Given that the experiment did not change the number of insects present, these findings indicate that the flowers were the signals the birds used to determine how much food was available. The fact that the flowering of honey mesquites coincides with the peak in abundance of migrant birds suggests that the timing and routes used by migrants may have evolved to take advantage of the readily available food resources that the flowering trees advertise.

Although our knowledge of how birds select locations to rest and refuel remains limited, this study demonstrates that the flowering phenology of a common tree species acts as a reliable cue for neotropical migrant birds. That the flowering of honey mesquite presents a reliable indicator of actual food availability highlights the importance of this visible signal for migrant bird populations, particularly along the Colorado River.

Avian migration along the Colorado River appears to be closely tied to the phenology of honey mesquite, but it remains uncertain how the phenology of honey mesquite or other tree species may influence migration along other important migratory corridors that differ geographically or in elevation. Those corridors may have different migratory peaks and support different bird populations or species assemblages. For these reasons, more work is needed to clarify how tree phenology differs among Western migration corridors, how these differences affect migratory bird populations, and how climate change and invasion by exotic trees may alter settlement cues used by migrant bird populations.

In the Western United States, neotropical migrant birds and the riparian corridors on which they depend are topics of conservation concern, and where these avian travelers stop to rest and refuel can have important conservation implications. For example, migratory birds may play an important role in ecosystem function in sensitive desert riparian corridors, because healthy bird populations may control insects that feed on local agricultural fields and native plants. Understanding where and why migrating birds stop during their annual travels can help land managers better care for key habitats for these long-distance avian travelers.

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