Is tropical deforestation responsible for the reported declines in neotropical migrant populations?

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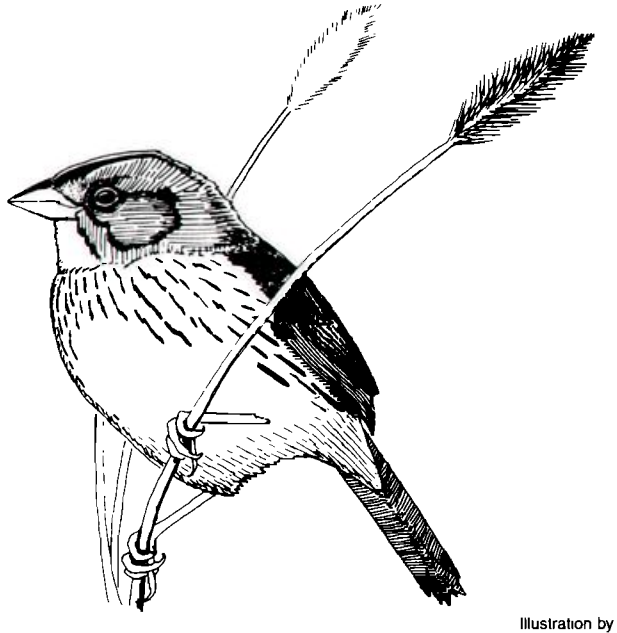
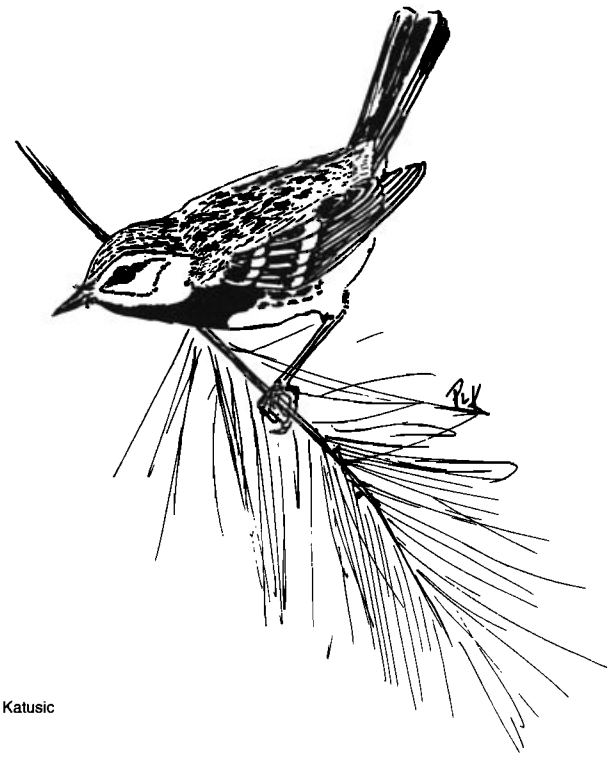


Illustration by Kenn Kaufman

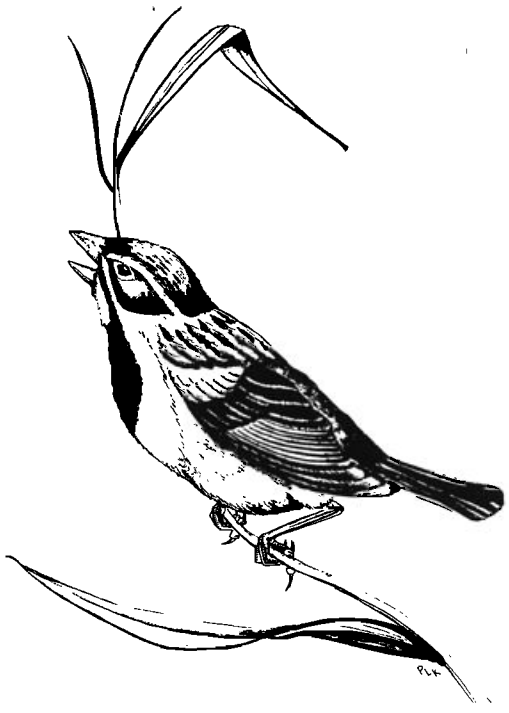
THE POPULATIONS OF MANY NEOtropical migratory bird species have reportedly been declining over the past 20–40 years (Aldrich and Robbins 1970; Walcott 1974; Criswell 1975; Temple and Temple 1976; B. L. Whitcomb *et al.* 1977; Briggs and Criswell 1979; Robbins 1979; R. F. Whitcomb *et al.* 1981; Ambuel and Temple 1982; Hall 1984). One factor that has received considerable attention as a cause behind such changes is the destruction of tropical forest communities (Briggs and Criswell 1979; Terborgh 1980; Ambuel and Temple 1982; Howe 1983; Lovejoy 1983; Rappole *et al.* 1983; Hall 1984). In fact, this explanation has already become dogma to many, as evidenced by the distillation of such "fact" into the popular press (Webster 1980; Deis 1981; Steinhart 1984).

I have had a difficult time reconciling this view with results from my own studies of neotropical migrants that winter in western Mexico where, it seems, most migrants are exceptionally numerous in disturbed habitats (Hutto 1980; Hutto 1988). Because virtually all the evidence for population declines has come from studies of eastern North American migrants, and because the eastern migratory system is geographically distinct from the western system (Barlow 1980; Fitzpatrick 1980; Fitzpatrick 1982; Keast 1980; Hutto 1985; Hutto 1988), I began to think that perhaps only the eastern migrants were declining. In order to repeat the kinds of studies that exposed the declining populations of migrants in the East, I needed to review the methods used by previous researchers.



Illustrations by Patti Katusic

In this paper, I wish to critically evaluate the sources of information that have been cited as evidence for widespread population declines, to evaluate the relative importance of alternative explanations for the reported declines in migrant populations, and to discuss some issues that must be ironed out before an improved monitoring of neotropical migrant populations can be realized.



Are neotropical migratory bird populations declining?

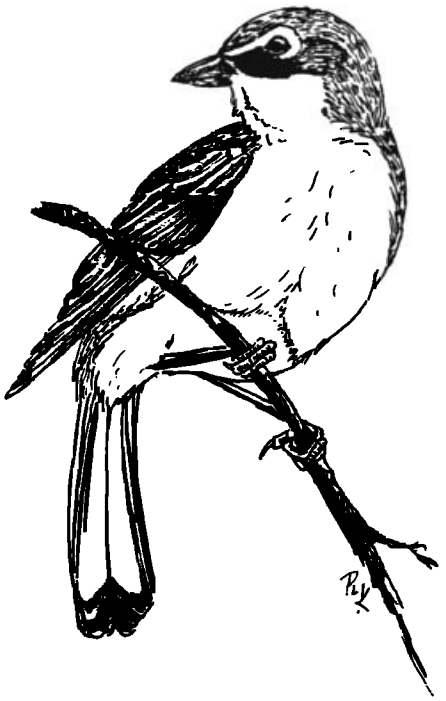
The earliest references that have been cited in support of the argument that neotropical migrants are declining are Carson (1962), Aldrich and Robbins (1970), and Vogt (1970). The evidence used by Carson and Vogt was entirely anecdotal. Aldrich and Robbins, however, used data from their preliminary analyses of the then-new Breeding Bird Survey to report that many migrants had decreased "markedly" (no data presented) during the prior 15 years, but they also stated that many other migrants did not change, and that still others increased. I think it is safe to say that the evidence is no more than suggestive on the basis of these early publications.

Since the mid-1970s, numerous additional publications based on objective census data have appeared (Walcott 1974; Criswell 1975; Temple and Temple 1976; B.L. Whitcomb *et al.* 1977; Briggs and Criswell 1979; Robbins 1979; R.F. Whitcomb *et al.* 1981; Ambuel and Temple 1982; Hall 1984), and these too have become widely cited. Subsequent claims of widespread population declines of migrants have been based entirely on extrapolations from these local studies. Furthermore, viable alternative explanations for population declines have been conveniently ignored in certain instances where the authors have been intent on building a case for the role of tropical deforestation (Webster 1980; Deis 1981; Howe 1983, Steinhart 1984; Stewart 1987).

Although problems in the design of many of the local studies have affected the precision of the results, I do not believe the conclusion that migrants have declined on those particular study plots can be seriously questioned. Two problems, however, prevent one from claiming that these studies provide the definitive evidence that migrants everywhere are declining. First, we might expect to find declines in five percent of the species or studies simply due to chance alone (at the five percent probability level). Could the generality of these results have become overemphasized because the rare but "interesting" declines were published; while the "dull" no-change studies were never submitted? Second, virtually all of the above citations represent local (vis-à-vis regional) studies. This makes it difficult to know whether the results from any one site are a reflection of more general trends from a larger region. The findings could be unique to those particular sites

Considered alone, the generality of declines in migratory bird populations is not entirely convincing, but the generality gains considerable strength when the studies are considered together; they undoubtedly represent trends that are generalizable beyond the immediate study areas involved because the same kinds of bird species—forest-interior, long-distance migrants—show up as the ones decreasing in each of the studies (Askins and Philbrick 1987). So where does this leave us? We know that forest-interior, long-distance migrants have declined in a number of selected study sites throughout the East. If the results reflect more general trends, then what kind of areas are likely to be undergoing similar changes? Are all forests throughout North America suffering such changes?

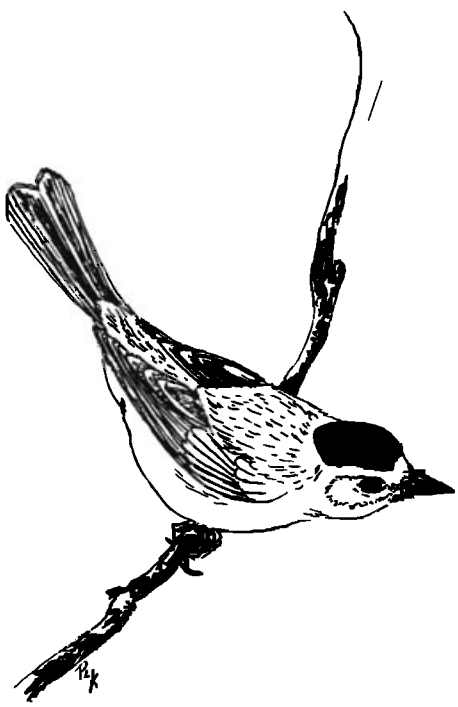
The Breeding Bird Survey data are well suited, if not ideal, for answering these sorts of questions because they are less sensitive to methodological biases and because analyses can be performed on regional data sets (Robbins *et al* 1986). In fact a perusal of the results from the first 15 years of data provides no evidence for widespread declines in forest migrants (Robbins *et al.* 1986). If anything, the taxonomic groups that contain mostly forest migrants (thrushes, gnatcatchers, vireos, war-



blers) show increases; sparrows comprise the only taxonomic group that shows fairly consistent downward trends in population sizes! What hypotheses would be consistent with both the local declines that have been reported and the regional stability that is apparent from the Breeding Bird Survey data?

The alternative hypotheses

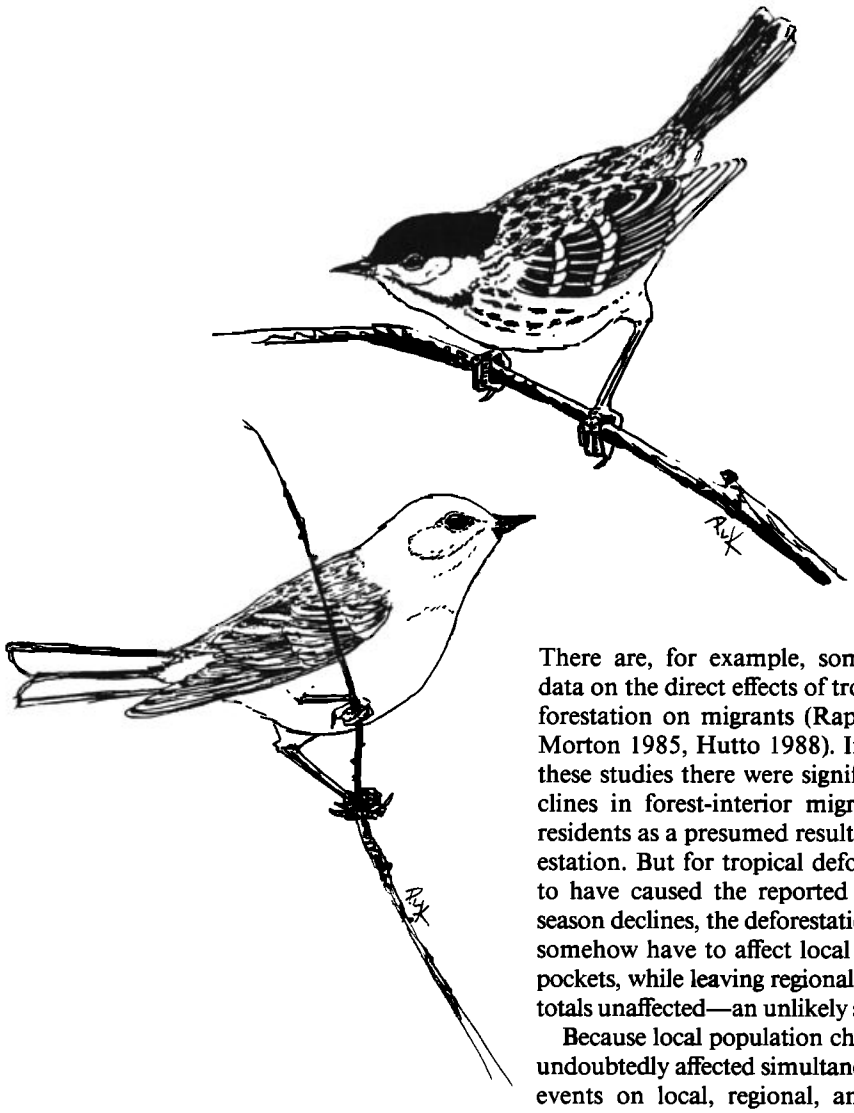
There are basically two classes of hypotheses that could explain the local declines in long-distance forest migrants (R.F. Whitcomb 1977; Wilcove and Whitcomb 1983). One class involves local events that have occurred on or near those particular study sites and have affected the birds during the breeding season, and the other class involves events that are spatially removed from the study plots and have affected the birds during the nonbreeding period. Except for the possibility of pesticide effects (Walcott 1974), all of the local factors that have been suggested to be important contributors to the decline in migrant populations are related to the destruction and fragmentation of forests. These include insularization effects (Robbins 1979; Robbins 1980; R.F. Whitcomb *et al.* 1981, Diamond 1984; Lynch and Whigham 1984; Askins and Philbrick 1987; Askins *et al.* 1987), an increase in nest predation (Gates and Gysel 1978; Ambuel and Temple 1983; Wilcove 1985), an increase in cowbird parasitism (Mayfield 1977; Bystrak and Robbins 1977; R.F. Whitcomb *et al.* 1981; Brittingham and Temple 1983), and competitive replacement by other species due to changes in habitat structure (Anderson 1979; Aldrich and Coffin 1980; Butcher *et al.* 1981; Ambuel and Temple 1983; Askins and Philbrick 1987). The only nonbreeding period events that have been suggested as important factors in the reported declines of migrant populations are the use of pesticides (Vogt 1970) and tropical deforestation (cited above).



Teasing apart the alternatives

The declines in migrant bird populations are hardly surprising when one realizes that the majority of areas used in the population studies are easily accessible urban preserves that are isolated from other forests (Askins and Philbrick 1987), rather than sections of contiguous forest located many kilometers into some wilderness area. Given such conditions, it's going to be difficult to convince anyone that the declines are related to anything but changes in some local conditions that affect migrants more than residents. Nonetheless, authors of local studies have argued that their sites have remained free from disturbance. For example, consider the most recently published study (Hall 1984) that illustrates the decline in migrants. Hall argues that his study site serves as a good example of a breeding season habitat that has remained "unchanged for more than 35 years", but he goes on with a description of how the site is essentially a triangular island that escaped a logging operation, how the understory had grown, how there were tree falls, and how the total area censused was less in the later years.

There is at least one published study (Anderson 1979) that was designed to detect the effects of a form of habitat alteration (the cutting of transmission-line corridors) that has occurred within many north temperate breeding areas, and the results mirror the classic population changes described in the "de-



clining migrant" studies. There is also a more detailed study (Askins and Philbrick 1987) of the recovery of some migrant populations after natural successional reforestation adjacent to a study area that had been reported earlier to have declining migrant populations. Finally, Askins *et al.* (1987) have just published an analysis that demonstrates a negative relationship between the degree of isolation of forest tracts and population sizes of forest-interior birds. Results from these studies suggest that the classic declines in abundance of long-distance migrants are closely linked to local events.

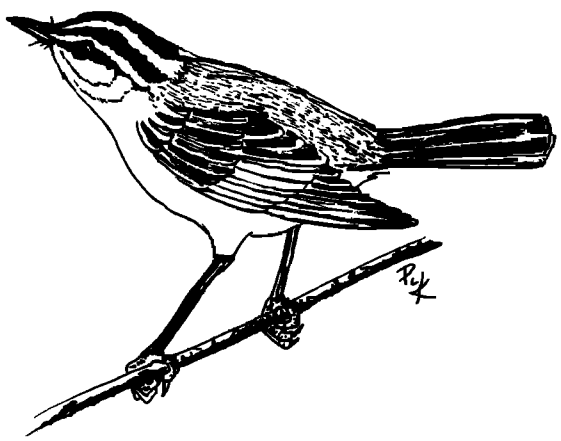
So where does that leave us in terms of the effect of tropical deforestation on migrants? There is no evidence that tropical deforestation has played a significant role in the declines reported in the breeding season. This is not to say that there have not been population declines due to tropical deforestation; it is simply that the reported declines can be better explained by local events.

There are, for example, some recent data on the direct effects of tropical deforestation on migrants (Rappole and Morton 1985, Hutto 1988). In both of these studies there were significant declines in forest-interior migrants and residents as a presumed result of deforestation. But for tropical deforestation to have caused the reported breeding season declines, the deforestation would somehow have to affect local breeding pockets, while leaving regional breeding totals unaffected—an unlikely situation.

Because local population changes are undoubtedly affected simultaneously by events on local, regional, and global scales (Holmes and Sherry 1986), we could concentrate on ways to use the existing Breeding Bird Survey data to tease apart the alternative hypotheses that have been proposed to explain the breeding season declines, and to weight the relative contribution of those hypotheses that cannot be disproven. For example, are there particular *species* that would be expected to have declined under the tropical deforestation hypothesis and not the others? Are there particular *geographic locations* that should be expected to show change under the tropical deforestation hypothesis and not the others? There may be ways to use existing data bases to get at these questions, but as Wilcove and Terborgh (1984) note, it will be no simple task

There is the initial problem of how to subdivide the data taxonomically The taxonomic subgroup that we expect to be affected under a given hypothesis demands that we know the details of the biology of each species in all seasons Note that even the group of birds that is reportedly declining has already changed from "migrants" to "long-distance migrants" to "forest-interior, long-distance migrants" as the hypotheses to explain the observed changes have become better focused With a better understanding of winter and migratory period biology, we might expect a further refinement of groups that should be affected under the alternative hypotheses.

A geographic analysis would be no less complex. For some species, the population at a given winter location may comprise individuals from widely separated breeding areas. The effects from an event in winter may, therefore, be spread over a huge area in summer, and would not be easily detected. For other species, a winter event may very well cause changes in a localized breeding population, but detecting such an event amid the combined Breeding Bird Survey results could be next to impossible. Only after we develop precise predictions that necessarily follow from the alternative hypotheses will we know how to divide the Breeding Bird Survey data for analysis and resolution of this puzzle. Meanwhile, perhaps we should be more careful about extrapolating from the results of local studies.



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