A COMPARISON OF AVIAN ABUNDANCE, BIOMASS, SPECIES RICHNESS AND FORAGING BEHAVIOR IN MESIC AND XERIC HABITATS IN A TROPICAL DRY FOREST

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ABSTRACT (LCB)

We examined bud abundance, species richness, and foraging activities in a tropical dry forest at Palo Verde National Park, Costa Rica. Based on a previous study we hypothesized that resources should be more diverse in xeric habitats, as reflected by avian foraging behaviors. Contrary to the previous study, abundance and species richness were significantly greater in the mesic habitat. Avian biomass averaged three fold higher in mesic habitats than in xeric habitats, but this difference was nonsignficant. Birds employed a greater variety of foraging maneuvers and substrates in mesic than xeric habitats. Our measurements of avian richness, foraging, and abundance suggest that resources are higher in mesic habitats. The differences in results between this and the previous study could be due to annual variation in plant phenology.

Key Words: avian biomass, bud foraging, species richness

INTRODUCTION (PLK)

If avian biomass is related to plant productivity, one might expect more mesic, and presumably more productive, areas to support higher avian biomass. However, Bansak et al. (1993 FSP) found no difference in avian biomass between mesic and xeric habitats at Palo Verde National Park in Costa Rica, and actually found greater species richness in xeric sites. Given these findings, we hypothesized that food resources should be more diverse in the xeric habitat. Using the diversity of foraging behaviors as an index to the diversity of food resources, we predicted that the diversity of foraging substrates, heights, food types and maneuvers would be highest in the xeric habitat.

METHODS (JJR)

Our study was conducted in forested habitats of the Palo Verde National Wildlife Refuge, Guanacaste Province, Costa Rica. We classified the dry forest into two categories based on moisture content. The xeric habitat was characterized by dry and sparse ground cover with high sun and wind exposure. The mesic habitat was characterized by dense vegetation at the ground and shrub levels; there was more shelter from sun and wind. We used existing trails as transects. Transects through mesic habitats included 1) Sendero Cerros Calizos from the Mirador turn-off to the mango stand and 2) the trail from the main dirt road to the cattle watering tank and along the dry creekbed from the water back to the road. Xeric transects included 1) the eastern half of Sendero Cerros Calizos, 2) 0.5km of Sendero La Venada beginning at its eastern road head and 3) 0.3km of Sendero Guayancito beginning at its road head.

During the mornings of 10 and 11 January, 1994, three pairs of observers walked these transects and recorded all bird sightings. We spent 9.5 hr and 7.1hr in mesic and xeric habitats respectively. If a bird was foraging, the food, substrate, foraging manuever and height from ground were recorded.

Biomass estimates for each habitat were obtained by multiplying the numbers of birds in each habitat by their average mass as given in Stiles and Skutch (1989). Student t-tests were used to test for differences in biomass, diversity and abundances between habitats. Foraging substrate, food, height and manuever were analyzed using Chi-square tests.

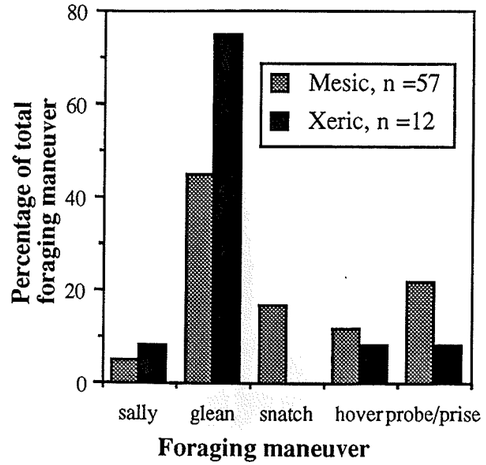

Figure 1. Comparison of foraging maneuver frequencies for mesic and xeric habitats (all species combined).

RESULTS (DJG)

Species richness and number of individuals seen per hour were significantly greater in the mesic habitat than the xeric habitat (Table 1). Mean biomass was ≈ 3 fold greater in the mesic habitat than in the xeric habitat, but the standard errors were very large due to the occasional occurrence of one large species (Guan) and this difference was non-signficant.

Foraging maneuvers did not differ between habitats ($X^2 = 3.60$, $p > 0.20$; Figure 1). In both habitats, gleaning was the most common foraging maneuver. Foraging height did not differ between habitats ($X^2 = 0.07$, $p > 0.50$; Figure 2).

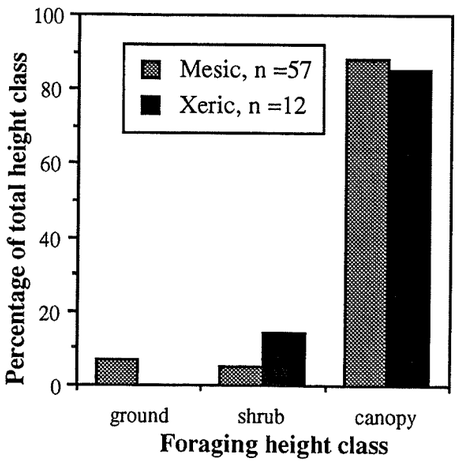

Figure 2. Comparison of height class frequency for mesic and xeric habitats (all species combined).

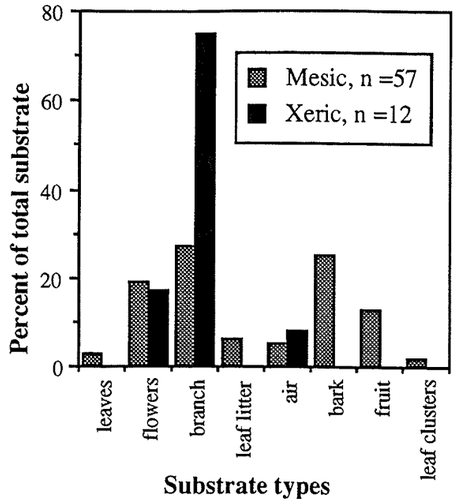

Figure 3. Comparison of substrate frequencies for mesic and xeric habitats (all species combined).

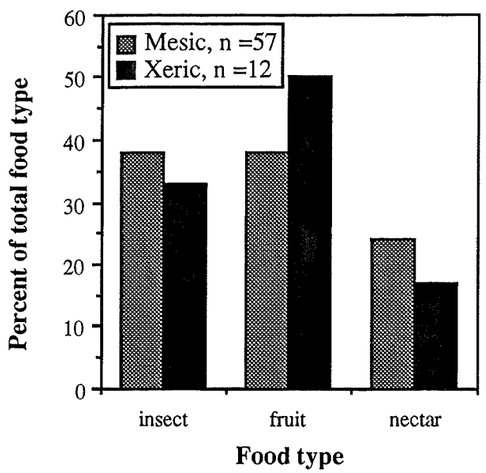

Figure 4. Comparison of food type frequencies for mesic and xeric habitats (all species combined).

Table 1: Abundance, biomass, and species richness of birds in mesic and xeric habitats within tropical dry forest at Palo Verde, Costa Rica (n = 7 transect censuses per habitat).

	Habitat Type (mean ± SE)		
	mesic	xeric	p
Individuals/hour	11.2 ± 1.2	4.5 ± 1.1	0.002
Biomass/hour	872 ± 437	293 ± 137	0.23
Number of species/hour	5.8 ± 0.5	2.9 ± 0.7	0.006

Foraging occurred primarily in the canopy; at least 85% of observations in both habitats were in this height class. In xeric habitats, 75% of foraging birds were using branches as a substrate, compared to only 27% in mesic habitats ($X^2 = 10.49$, $p < 0.05$; Figure 3). Principal food types did not differ between habitats ($X^2 = 0.61$, $p > 0.50$; Figure 4). Insects and fruit comprised ≈80% of food types in both mesic and xeric habitats.

DISCUSSION (DBZ)

Our results showed greater avian abundance and species richness in the mesic habitat, contrary to the results of Bansak et al. (1993 FSP). The differences between studies may be due to differences in methodology. Bansak et al. (1993 FSP) used a point count method and allowed birds to habituate to the presence of observers. In our study, we moved slowly but continually along the trails, which may have reduced our chances of seeing quiet cryptic species. Differences between the studies may also be due to annual variation in the onset of the dry season, which could influence the phenology of fruiting and impact bird foraging habitats.

Our hypothesis that resources are more diverse in the xeric habitat assumed that avian abundance and species richness were greater in the xeric habitat (Bansak et al., 1993 FSP). Given our results, we would have instead predicted a greater diversity of resources in the mesic forest. This was supported by a greater diversity of foraging substrates within the mesic habitat (Figure 3).

We suggest that bird foraging behavior at Palo Verde is a joint function of forest architecture and resource availability. Gleaning may have been the dominant foraging maneuver in both habitats because of the high abundance of substrates suitable for gleaning (e.g. bark and branches). We hypothesize that birds foraged primarily in the canopy because food resources were most abundant there. The disproportionately high use of branches in xeric habitats may be due to a shortage of alternative substrates such as fruit and leaf litter that seemed more abundant in mesic habitats. Alternatively, food resources per branch may be disproportionately higher in xeric habitats.

Our hypothesis relating bird diversity to foraging resources requires further examination. Ideally future studies would include more bird observations. Direct measurements of food resources would be a useful complement to this research.

LITERATURE CITED

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