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Neotropical migrants in marginal habitats on a Guatemalan cattle ranch.—Recent studies of migratory birds overwintering in Central America and the Caribbean have focused on bird communities in particular types of disturbed habitats, such as citrus orchards (Rogers et al. 1982, Mills and Rogers 1992) or agricultural fields in varying stages of succession after human abandonment (Waide 1980, Kricher and Davis 1989), while others have attempted to discern broader patterns of species occurrence across a wide variety of habitat types (Waide et al. 1980, Leck 1985, Lynch 1989, Robbins et al. 1992, Wunderle and Waide 1995). Although a few in the latter category have included a small amount of data from cattle ranches, Central American cattle ranches have received little attention in the ornithological literature. This is unfortunate because conversion to cattle ranching is the single largest threat to the remaining undisturbed lands in Central America (Myers 1980, Buschbacher 1986, Lynch 1989). Given the amount of land already used for cattle ranching in Central America and the amount likely to be converted in the near future, knowledge of patterns of species occurrence on land modified for cattle ranching is critical for formulating future conservation strategies.

We mist netted birds on an active cattle ranch in the Pacific lowlands of Guatemala to investigate the extent to which narrow riparian corridors and other marginal habitat set in a matrix of open cattle pasture serve as usable habitat for overwintering migratory birds.

Study area and methods.—We conducted the study from 2 February to 2 March 1995 on Finca Caobanal, a working cattle ranch in the Pacific lowlands of Guatemala. The region is characterized by relatively flat topography with elevation ranging from sea level to approximately 200 m. The average annual temperature is 25°C, and annual rainfall averages 200 cm, with a pronounced dry season between November and April (Universidad Rafael Landívar 1987). Although the native vegetation type is subtropical humid forest, the vast majority of the region has been converted to agricultural land, particularly cattle pasture, and more recently, sugar cane.

Finca Caobanal comprises approximately 1000 ha situated along the Maria Linda River, about 30 km southeast of the town of Escuintla. The ranch is a mosaic of open pastures separated by hedgerows and artificial canals lined with narrow corridors of secondary growth vegetation and one 250-ha parcel of secondary growth forest. The riparian corridors range in width from approximately 10–80 m; lower and mid-story vegetation is generally dense and is dominated by tall grasses, *Heliconia* sp., *Acacia hindsii, Ricinus communis* and *Piper* sp. Isolated overstory trees include *Pithecolobium saman, Bombax ellipticum, Acacia hindsii, Enterolobium cyclocarpum, Salix* sp. and *Ficus* sp. In the secondary growth forest, dominant tree species include *Terminalia oblonga, Cedrela odorata, Ficus* sp., *Triplaris malaenodedron* and *Cecropia* sp., and the average canopy height is 15–20 m. The understory is relatively open, but in some places is dominated by large patches of *Heliconia* sp.

Although previous studies that surveyed avian communities on cattle ranches in Central America (Saab and Petit 1994, Robbins et al. 1992, Lynch 1989) focused on open pasture, deliberately avoiding edges and hedgerows, we focused our mist netting efforts in the vegetation on the margins of actively grazed cattle pastures, in the riparian corridors along the irrigation canals, and in the 250 hectare forest. Two to seven black nylon 30 mm mesh nets (depending on habitat shape and size) were operated daily, generally in a line with approximately 12m between each net, and one or two nets situated perpendicular to the others. In order to avoid heat stress on the birds, nets were checked every 15 min and were closed between approximately 10:30 and 15:00. Nets were moved every three days to lessen the problem of net shyness and were open for a total of 446 net-h. Birds were marked with indelible ink underneath the wing in order to identify recaptures.

Mist netting is strongly biased against species that spend most or all of their time in the canopy, and this investigation should therefore be viewed as a study of primarily understory birds. Additionally, using mist net data to infer absolute species abundance directly is problematic because some species have a higher probability of capture than others; nonetheless, when interpreted cautiously such data can still serve as a meaningful index of relative species abundance (Karr 1981).

Results.—We caught 258 individual birds of 45 different species; 49% of individual birds were long-distance migrants, and 51% were residents (Table 1). This approximately 1:1 ratio of overwintering migrants to residents is consistent with other published netting studies conducted in secondary growth habitats in Central America and the Caribbean (Lynch 1989, Waide 1980).

The five migratory songbird species most frequently captured were Yellow Warbler, *Dendroica petechia* (N = 22), Common Yellowthroat, *Geothlypis trichas* (N = 16), Northern Waterthrush, *Seiurus noveboracensis* (N = 10), Yellow-breasted Chat, *Icteria virens* (N = 8), and Painted Bunting, *Passerina ciris* (N = 15). The first four species are widely reported to be abundant on disturbed and/or agricultural lands in Central America (Rogers et al. 1982, Kricher and Davis 1992, Petit et al. 1992, Robbins et al. 1992, Lynch 1992, Mills and Rogers 1992), but the Painted Bunting is less well-documented as an inhabitant of severely human-modified environments in Central America.

Capture rates of birds in the riparian corridors were strikingly different from those in the secondary growth forest; working in the corridors we caught an average of 76 birds per 100 net-h, compared to only 20 birds per 100 net-h in the forest ($\chi^2 = 30.5$, $P < 0.01$). The low capture rate in the forest may have resulted partly from the fact that the average forest canopy height was considerably greater than in the corridors, and consequently canopy-foraging birds may never have flown low enough in the forest to be captured. We do not believe this entirely explains the disparity, however, as casual observations also indicated a greater density of birds in the riparian corridors. Although casual observations may have been biased by a lower probability of detection of birds in the forest canopy, the corrobo-

TABLE 1
BIRD SPECIES NETTED AT FINCA CAOBANAL

Species	Number captured	Migratory status
Ruddy Ground-Dove (*Columbina talpacoti*)	3	R
Common Ground-Dove (*C. passerina*)	1	R
Groove-billed Ani (*Crotophaga sulcirostris*)	1	R
Cinnamon Hummingbird (*Amazila rutila*)	28	R
Ruby-throated Hummingbird (*Archilochus colubris*)	1	M
Amazon Kingfisher (*Cholorceryle amazona*)	1	R
Smoky-brown Woodpecker (*Venilornis fumigatus*)	1	R
Ivory-billed Woodcreeper (*Xiphorynchus flavigaster*)	2	R
Barred Antshrike (*Thamnophilus doliatus*)	1	R
Rufous-breasted Spinetail (*Synallaxis erythrothorax*)	8	R
Rose-throated Becard (*Pachyramphus aglaiae*)	2	M
Dusky-capped Flycatcher (*Myiarchus tuberculifer*)	2	M
Unknown Flycatcher (*Empidonax* sp.)	1	R
Least Flycatcher (*E. minimus*)	11	?
Yellow-olive Flycatcher (*Tolmomyias sulphurescens*)	1	R
White-throated Spadebill (*Platyrinchus mystaceus*)	1	R
Unknown Pewee (*Contopus* sp.)	3	?
Common Tody-flycatcher (*Todirostrum cinereum*)	4	R
Mangrove Swallow (*Tachycineta albilinea*)	1	R
Barn Swallow (*Hirundo rustica*)	17	M
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	3	M
Rufous-naped Wren (*Camplylorhynchus rufinucha*)	4	R
Swainson's Thrush (*Catharus ustulatus*)	4	M
Clay-colored Robin (*Turdus greyi*)	25	R
Bell's Vireo (*Vireo bellii*)	1	M
Tennessee Warbler (*Vermivora peregrina*)	1	M
Black-and-White Warbler (*Mniotilta varia*)	1	M
Magnolia Warbler (*Dendroica magnolia*)	2	M
Yellow Warbler (*D. petechia*)	22	M
MacGillivray's Warbler (*Oporornis tolmiei*)	2	M
Kentucky Warbler (*O. formosus*)	1	M
Hooded Warbler (*Wilsonia citrina*)	1	M
Worm-eating Warbler (*Helmithers vermivorus*)	1	M
Ovenbird (*Seiurus aurocapillus*)	3	M
Northern Waterthrush (*S. noveboracensis*)	10	M
Common Yellowthroat (*Geothlypis trichas*)	16	M
Yellow-breasted Chat (*Icteria virens*)	8	M
American Redstart (*Setuphaga ruticilla*)	1	M
Northern Oriole (*Icterus galbula*)	1	M
Blue-gray Tanager (*Thraupis episcopus*)	4	R
Painted Bunting (*Passerina ciris*)	15	M
Indigo Bunting (*P. cyanea*)	4	M
White-collared Seedeater (*Sporophila torqueola*)	28	R
Blue-black Grassquit (*Volatina jacarina*)	9	R
Grayish Saltator (*Saltator coerulescens*)	1	R

ration of the mist-net data is highly suggestive that there is indeed a greater density of birds in the riparian corridors than in the secondary forest patch.

Discussion.—Our results suggest that lands already under use for cattle ranching should not simply be written off as lost by conservation advocates; riparian vegetation corridors and other marginal habitat patches on cattle ranches can be valuable habitat refuges for a large variety of migrant and resident species. Although large-scale clearing of forest for cattle ranching is surely disastrous to many birds, as well as other animal and plant species, in an area like the Pacific lowlands of Guatemala, where virtually all of the forest has already been cleared (Universidad Rafael Landívar 1987), there may still exist valuable conservation opportunities.

In the region where we conducted our study, there exists a wide variety of land management strategies on different cattle ranches and farms; some allow relatively lush corridors of vegetation and overstory trees to grow along irrigation canals and fence lines, while others bulldoze virtually all vegetation. These differing practices surely have an enormous impact on bird communities. Even at Finca Caobanal, riparian corridors are massively cut back once or twice a year; the seasonal timing of this event may profoundly affect the suitability of the area for overwintering migrants or the nesting success of residents.

Conservation advocates in North America as well as Central America must concern themselves not only with securing the last, isolated parcels of undisturbed habitat for preservation, but just as importantly, with influencing land-management practices on lands that have already been modified by humans. Future research should provide a basis for prescribing beneficial management practices, so that the harm done in clearing forests for cattle ranching or agriculture is mitigated to the greatest extent possible.

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Ungulate ectoparasite removal by Black Caracaras and Pale-winged Trumpeters in Amazonian forests.—Interspecific interactions in which an organism eats the ectoparasites of another, usually larger, organism (sometimes referred to as "cleaning symbioses"; Wittenberger 1981) comprise a relatively common form of mutualism. In terrestrial vertebrates, these associations are chiefly represented by a few bird species which routinely remove ticks and hematophagous diptera from large mammals. Such interactions, however, are by no means regularly distributed across different macrohabitats and appear to be more common in tropical savannas where recent radiations of large herbivores and their parasites are most impressive. Cleaning mutualisms are thus perhaps best illustrated by certain savanna bird species of sub-Saharan Africa such as Yellow-billed (*Buphagus africanus*) and Red-billed oxpeckers (*B. erythrorhynchus*) which are highly specialized in plucking ticks from a wide range of wild and domestic ungulate hosts for the mainstay of their diet (Attwell 1966, Bezuidenhout and Stutterheim 1980, Hart et al. 1990). In other open habitats, similar interactions also occur less frequently, for example, between Fan-tailed Ravens (*Corvus rhipi-*