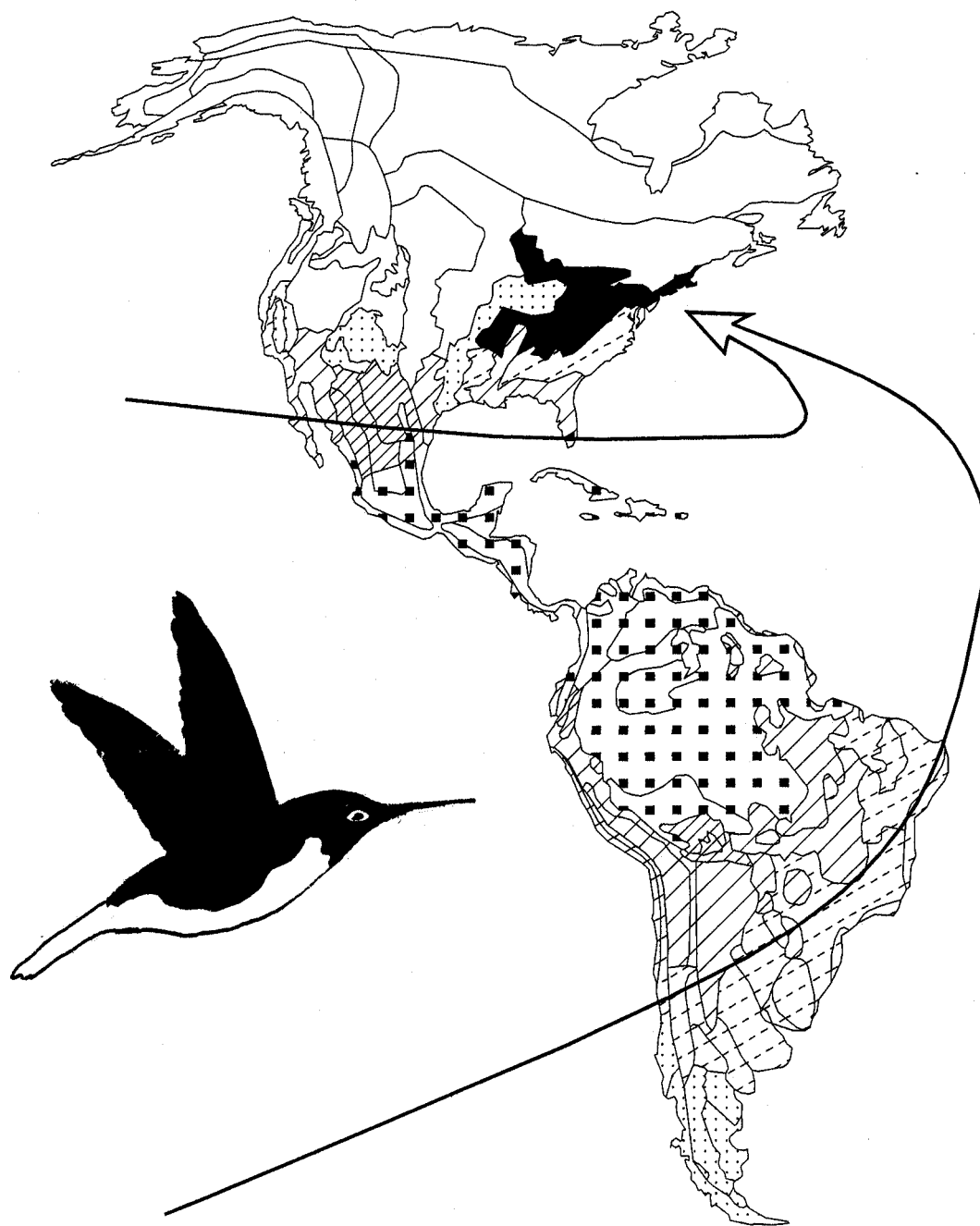


# SHARED MIGRATORY BIRDS BETWEEN NORTH AND LATIN AMERICA



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## INTRODUCTION

In order to evaluate priorities for potential cooperative relationships in the Sister Forest program of National Forest units in the United States and various units in Latin America, we have compiled an analysis of the shared migratory avifauna of the two regions. It is intended that these Sister Forest relationships would be based in part on the Neotropical Migratory Bird Conservation Program which involves a mutual concern about the status of various species breeding in North America and wintering in Latin America. The Program includes aspects of inventory, monitoring, in-depth research, and education about the birds.

For purposes of this demonstration of the potential of the method, we show some of the parameters placed in the data base and a few of the many potential applications to determine relationships between the breeding and wintering grounds of migrants. As an example of an application, we compare four candidate National Forest units with prospective areas in Latin America. To enable readers to use the database, tables and appendices are provided on diskette as ASCII files accompanying this report. Examples of those tables are included in the report.

## METHODS

Ranges of species.--We plotted the breeding and wintering ranges of

156 species (Appendix A - on diskette) of migratory birds in a GIS environment. We used Arc/Info version 6.1 running on a Sun SPARC station #2 workstation. We plotted those species that have the majority of their breeding range north of the U.S. and Mexico border, and the majority of their winter range in Latin America, from Mexico south. We first consulted Inkley (1985) for bird ranges in both North America and Mexico, then AOU (1983) to confirm these ranges and to add South American ranges. Finally, we consulted standard field guides such as NGS (1987) and Peterson and Chalif (1990). Ranges of birds are subject to much interpretation and it is likely that no two observers would agree on the range of any single species. This is primarily a problem of scale and determination of abundance within that scale. The standard field guides allocate range according to a very large scale of several hundred kilometers. Areas with small or marginal populations can be included or excluded in what might seem to be a capricious manner. An example would be a species that does not normally breed in numbers in the Central Valley of California, a former grassland, now almost entirely agriculture. However, the valley might well be included in its range if substantial numbers breed at its forested margins, and occasionally penetrate into the valley itself. Despite these problems, the ranges as we entered them are, to the best of our ability, a composite of scales, but equivalent approximately to that in standard field guides.

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The range of a bird was considered to be within a given ecoregion if its range occupied at least 25% of that ecoregion. Presence or absence of each bird species by ecoregion was determined for both the breeding and wintering ranges (Appendix B and Appendix C - on diskette). Of the 255 North American species which are migratory to some extent, we excluded 99 species. We excluded short-distance migrants that barely make it south of the U.S. border, species that barely breed north of the Mexico-U.S. border, and species that breed only in Florida.

**Ecoregions.**--The habitat types of North and Central America were then compiled, based on the Bailey (1976) ecoregions, resulting in 43 separate ecoregions (Figure 1 and Table 1). Habitat types in South America were based on UNESCO (1980), resulting in 68 separate ecoregions in this continent (Figure 2 and Table 2). We simplified the UNESCO system that is based on a multi-level classification of climate and vegetation. Some ecoregions had disjunct distributions, and each disjunct ecoregion was treated separately. For simplicity, we have referred to only the vegetation component in these classifications, and have simplified and consolidated some of the vegetation types.

**Species at risk.**--In order to determine a priority weighting scheme, we derived a rating system from the Colorado Bird Observatory's Partners in Flight Prioritization Ranks (1993) (Appendix E - on diskette) that estimates the risk of extinction to the species on the basis of various attributes. Each species was ranked on a scale of 1 to 5 in six different categories. A ranking of 5 would mean a species at highest possible risk, and a 1 would indicate no perceived risk. The six categories were as follows, with a high ranking of 5 describing: (1) a marked downward trend population trend based on Breeding Bird Surveys of the U.S. Fish and Wildlife Service over the last ten years; (2) only small, local populations remaining; (3) a small breeding range; (4) a small wintering range; (5) high perceived threats to the breeding habitat; and (6) high perceived threats to the wintering grounds. The highest ranking species totaled 28 out of 30 points were the Bachman's, Golden-cheeked, and Kirtland's warblers. The lowest ranked, with 6 points, was the globally-dis-

tributed, and very common, House Wren.

**Sister Forests.**--Each of the four U.S. candidate forests selected for this example were in different ecoregions (Figure 3). For each we tallied the number of breeding bird species occurring in the ecoregion and determined the number of those birds that winter in each Latin American ecoregion. Potential Sister Forest matches were derived by finding ecoregions with a high number of matches in Latin America for each of the U.S. forest candidates.

## RESULTS

### Example of Breeding and Wintering Ranges

The breeding and wintering range of each of the 156 species was plotted and was the basis of this comparison. An example is that of the Western Tanager (Figure 4), a neotropical migrant of western North America. It breeds typically in the mountain west and winters from the southern tip of Baja California and from southern Mexico down along the western coast of Central America. The Golden-winged Warbler (Figure 5) is a eastern North American migrant, generally found in the forested regions of the northeastern U.S. and southeast Canada, migrating to Central America and northern South America.

### Density of Species per Ecoregion

Based on breeding range, the highest number of neotropical migrants occurs in the Eastern Deciduous Forest and Tall-grass Prairie ecoregions, with more than 70 species in each (Figure 6). Substantial numbers of more than 60 species each are found in the Rocky Mountain Forest and Colorado Plateau ecoregions, as well as the eastern U.S. ecoregions of Laurentian Mixed Forest and the Prairie Parkland. Further north, fewer species occur in the harsher boreal and arctic regions, and further south more species are resident.

During the winter season, there is an increased concentration of species from the Mexican Central Plateau through the Central American Mountains and into the Greater Antilles (Figure 7), with more than 80 species in the four ecoregions in those areas. Substantial numbers are also found in the three mountain ecoregions of central Mexico, and the Central American Atlantic Lowlands. Northern South Amer-

ica has relatively few species, as most are intercepted by the rich areas to the north.

Degree of risk to species in each ecoregion.

We found a similar distribution when we weighted each species by the degree of perceived risk to the species from population declines, small ranges, or other factors. The areas which had the largest total number of species did not change their relative ranks, either in their breeding (Figure 8) or wintering (Figure 9) grounds when we examined the total weighted number of species.

#### Breeding Ranges of Migrants Wintering in Latin America

We have compiled the breeding ranges of all species that winter in each of the ecoregions of Latin America. Overall, as other authors have suggested (e.g. Hutto 1986, Carter and Barker 1992), species wintering in Mexico, especially western Mexico, derive from populations in the western United States. Species wintering in northern South America derive from species largely breeding in the eastern United States and southern Canada. We present a complete listing of the source of all migrants in North America for each of ecoregions in Latin America (Appendix D - on diskette). As a graphic example we present two of the Latin American ecoregions and the areas of origin of the species wintering there.

**Central Pacific Coast of Mexico.**--This area of western Mexico, in the states of Sinaloa and Nayarit, derives its breeding birds from much of mountain and intermountain areas of the western United States (Figure 10). Of the 76 species wintering there, the majority of species come from the Rocky Mountains and Sierra Nevada Mountains. Far fewer come from the eastern United States and Canada.

**Extremely Moist Forest of Northwestern South America.**--By contrast to the above, of the 37 species of neotropical migrants wintering in this forest area, the great majority come from the eastern United States and southern Canada (Figure 11).

#### Wintering ranges of North American Migrants

As a reciprocal analysis to the above, we have also compiled the Latin American wintering ranges of all species of neotropical migrants for each

North American ecoregion. As before, we present a complete listing of the wintering range of all migrants from Latin America for each of the ecoregions of North America (Appendix D - on diskette). We will also show a representative sample of the ecoregions in North America and the winter distribution of their breeding species.

**Intermountain Sagebrush.**--Of the 52 species breeding in this ecoregion, the majority winter in Mexico (Figure 12), with 40 in the Highlands of Central Mexico Ecoregion. Relatively few winter in Central America and fewer still in South America.

**Great Plains-Shortgrass Prairie.**--The wintering grounds of the 58 species breeding in this ecoregion (Figure 13) are also largely found wintering in Mexico, although less concentrated there, with more farther south and east. The species are numerous into the Greater Antilles, down into Central America, and in northern South America.

**Subarctic Low Forest.**--Thirty-six species breed in this ecoregion, spread across most of Canada. The highest density of wintering species is found in Central America and northern South America (Figure 14), further east and south of the two previous ecoregions.

**Eastern Deciduous Forest.**--Of the 71 species breeding here, the highest densities are found in Central America and northwestern South America (Figure 15). In general, the birds of this ecoregion are more widely distributed than those to the north and west.

#### Sample Candidate Forests

Below we will take up four North American units and evaluate their association with Latin American areas as an example of the way in which the data can be used.

**Prescott National Forest, Arizona.**--This forest is located in the Rocky Mountain Forest Ecoregion II (#25) (Figure 3 and Figure 1). A proposed match for this forest is Sierra de Manantlan Biosphere Reserve in Jalisco, Mexico, located primarily in the Highlands of Southern Mexico Ecoregion (#40), and near the Pacific Coast of Southern Mexico Ecoregion (#41). The highland ecoregion contains the highest match for the Prescott in Latin America (Table 3), with 55 species shared. Other ecoregions in central Mexico and northern Central

America have fewer shared species. Weighting this comparison for species at risk, results in the same ordering of Latin American regions.

Appalachian Mountains forests, Virginia and West Virginia.--These forests are in the Eastern Deciduous Forest Ecoregion (#30), and on the boundary of the Southeastern Mixed Forest Ecoregion I (#31). A proposed Sister Forest is in the vicinity of La Amistad, Costa Rica, along the Caribbean slope of the country located in the Central American Mountains Ecoregion (#42), and the Central American Atlantic Lowlands ecoregion (#43). Among the highest matches of shared avifauna of the U.S. forests in the Deciduous Forest Ecoregion are these two Latin American ecoregions with 47 and 46 species shared, respectively. Weighting for declining species results in identical matches. These Latin American ecoregions also have high matches with the nearby Southeastern Mixed Forest ecoregion (Table 3).

Mark Twain National Forest, Missouri.--This forest is located in the center of the Eastern Deciduous Forest Ecoregion (#30). The proposed Sister Forest is the El Cielo Biosphere Reserve in Tamaulipas, Mexico, located in the Sierra Madre Occidental Ecoregion (#34), and near the Central American Atlantic Lowlands Ecoregion (#43). While the latter, nearby ecoregion shares 46 species, a high number, the primary ecoregion shares only 19 species, fairly low in comparison with other ecoregions in Latin America. This is also only a moderate match when the weighted values are used.

Hiawatha and other National Forests, Michigan.--The Hiawatha is located in the Laurentian Mixed Forest Ecoregion (#13). A suggested match is the Sierra de las Minas in Guatemala, located in the Central American Mountains ecoregion, close to the lowland ecoregion matched in other comparisons above. Both these two ecoregions have a high number shared species with 38 species shared. Using the weighted value, the two regions are also quite similar.

#### DISCUSSION

The data base described here has great value for evaluating opportunities associated with the conservation of migratory neotropical birds. We have attempted to show a few facets of

the data base. However, the complexity of the potential uses of the data base precludes a detailed approach for this report. The main value of the data base will be its use in answering a variety of specific questions revolving around questions of biogeography and the declines of certain species.

Of the comparisons made between ecoregions for matches of shared avifauna, the highest values for shared species were the Eastern Deciduous Forests with the Central American Mountains and Lowlands ecoregions. There are, however, other ways of considering these data which may give a different perspective on some of these comparisons. For instance, they could involve limiting the comparisons to species not previously covered by other Sister Forest relationships. We will be glad to assist anyone seeking information or wishing to use the data base.

#### ACKNOWLEDGMENTS

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Table 1. Ecoregions of North America based on R.G. Bailey, 1976

1. Bering Tundra	24. America Mojave-Colorado-Sonoran
2. Yukon Parkland	25. Rocky Mountain Forest II
3. Alaska Range	26. Colorado Plateau
4. Yukon Forest	27. Chihuahuan Desert
5. Brooks Range	28. Prairie Brushland
6. Arctic Tundra	29. Prairie Parkland
7. Subarctic Mountain, Far North Rockies, MacKenzie-Selwyn-Pelly	30. Eastern Deciduous Forest
8. Subarctic Low	31. Southern Mixed Forest I
9. Pacific Forest	32. Southern Mixed Forest II
10. Warm Continental Plateau, Fraser Plateau	33. Central Pacific Coast Mexico, Sinaloa-Nayarit
11. Columbia Forest I	34. Sierra Madre Occidental
12. Tall-grass Prairie	35. Mexican Highland Shrub Steppe
13. Laurentian Mixed Forest	36. Sierra Madre Oriental
14. Willamette-Puget	37. Outer Coastal Plain Forest
15. Palouse Grassland	38. Everglades
16. Intermountain Sagebrush	39. Mexican Central Plateau
17. Rocky Mountain Forest I	40. Highlands of Southern Mexico
18. Wyoming Basin	41. Atlantic Coast of Mexico, Yucatan, Isthmus of Tehuantepec, Pacific Coast of Southern Mexico and Central America
19. Columbia Forest II	42. Central American Mountains
20. Great Plains Short-grass Prairie	43. Central American Lowlands
21. Sierran Forest	
22. California Grassland	
23. California Chaparral	

Table 2. Ecoregions of South America based on UNESCO, 1980

44. Extremely Moist Forest	79. Puna
45. Very Moist Forest	80. Grassland with Palms
46. Forest/Woodland/Thicket	81. Swamp Forest
47. Forest/Woodland/Thicket	82. Deciduous Forest and "Cerradao"
48. Forest/Woodland/Thicket	83. Deciduous Forest and "Cerradao"
49. Swamp Forest	84. Grassland with Woody Species
50. Grassland with Woody Species	85. Degraded Formations and Crops
51. Swamp Forest	86. Scrub
52. Extremely Moist Forest	87. Drought-deciduous Woodland and "Chaco"
53. Flooded Grassland	88. Flooded Grassland and "Pantanal"
54. Seasonal Forest	89. Grassland with Woody Species
55. Paramo	90. Grassland with Woody Species
56. Evergreen Submontane Forest	91. Crops
57. Crops	92. Degraded Formations and Crops
58. Grassland with Woody Species	93. Degraded Formations and Crops
59. Seasonal Forest	94. Seasonal Forest
60. Ombrophilous Submontane Forest	95. Deciduous Forest and "Cerradao"
61. Extremely Moist Forest	96. Grassland with Palms
62. Evergreen Submontane Forest	97. Xeromorphic Forest
63. Ombrophilous Submontane Forest	98. Grassland
64. Grassland with Woody Species	99. Crops
65. Deciduous Forest and "Cerradao"	100. Riparian Thorn Forest
66. Grassland with Woody Species	101. Evergreen Shrubland
67. Flooded Grassland	102. Subpolar Deciduous Shrubland
68. Flooded Grassland	103. Deciduous Forest
69. Extremely Moist Forest	104. Crops
70. Very Moist Forest	105. Xeromorphic Woodland
71. Seasonal Forest	106. Semi-deciduous Shrubland
72. Deciduous Forest and "Cerradao"	107. Deciduous Scrub
73. Xeromorphic Forest	108. Subpolar Deciduous Shrubland
74. Deciduous Forest and "Cerradao"	109. Deciduous Open Shrubland
75. Thorn-forest with Succulents	110. Tundra
76. Seasonal Forest	111. Moist/Very Moist Forest
77. Desert	112. Tundra
78. Mixed Mountain Forest	

Table 3. Number of species in common and weighted species values for potential sister forest units in ecoregions of North and Latin America. Ecoregions are identified by name and number.

		North American Ecoregion							
		Rocky Mountain II (#25)		Eastern Deciduous (#30)		South-east Mixed I (#31)		Laurentian Mixed (#13)	
		spp	wt	spp	wt	spp	wt	spp	wt
Latin American Ecoregion									
Pacific/Atlantic Coast of Mexico	(#41)	40	638	47	818	39	661	40	667
Central American Atlantic Lowlands	(#43)	31	480	46	802	38	646	38	629
Highlands of Southern Mexico	(#40)	55	914	37	616	31	504	29	455
Central American Mountains	(#42)	37	589	47	816	38	641	38	632
Sierra Madre Occidental	(#34)	52	864	19	296	15	220	17	251

## Appendix A. Common and latin names of neotropical migratory birds species used in this analysis

American Swallow-tailed Kite	<i>Elanoides forficatus</i>
Mississippi Kite	<i>Ictinia mississippiensis</i>
Common Black-Hawk	<i>Buteogallus anthracinus</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Swainson's Hawk	<i>Buteo swainsoni</i>
Zone-tailed Hawk	<i>Buteo albonotatus</i>
Merlin	<i>Falco columbarius</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Mountain Plover	<i>Charadrius montanus</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
Long-billed Curlew	<i>Numenius americanus</i>
Band-tailed Pigeon	<i>Columba fasciata</i>
White-winged Dove	<i>Zenaida asiatica</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Flammulated Owl	<i>Otus flammeolus</i>
Elf Owl	<i>Micrathene whitneyi</i>
Burrowing Owl	<i>Athene cunicularia</i>
Lesser Nighthawk	<i>Chordeiles acutipennis</i>
Common Nighthawk	<i>Chordeiles minor</i>
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Black Swift	<i>Cypseloides niger</i>
Chimney Swift	<i>Chaetura pelagica</i>
Vaux's Swift	<i>Chaetura vauxi</i>
White-throated Swift	<i>Aeronatus saxatalis</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>
Black-chinned Hummingbird	<i>Archilochus alexandri</i>
Costa's Hummingbird	<i>Calypte costae</i>
Calliope Hummingbird	<i>Stellula calliope</i>
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>
Rufous Hummingbird	<i>Selasphorus rufus</i>
Allen's Hummingbird	<i>Selasphorus sasin</i>
Olive-sided Flycatcher	<i>Contopus borealis</i>
Greater Pewee	<i>Contopus pertinax</i>
Western Wood-Pewee	<i>Contopus sordidulus</i>
Eastern Wood-Pewee	<i>Contopus virens</i>
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>
Acadian Flycatcher	<i>Empidonax virescens</i>
Alder Flycatcher	<i>Empidonax alnorum</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Least Flycatcher	<i>Empidonax minimus</i>
Hammond's Flycatcher	<i>Empidonax hammondi</i>
Dusky Flycatcher	<i>Empidonax oberholseri</i>
Gray Flycatcher	<i>Empidonax wrightii</i>
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>
Cordilleran Flycatcher	<i>Empidonax occidentalis</i>
Buff-breasted Flycatcher	<i>Empidonax fulvifrons</i>
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>
Great Crested Flycatcher	<i>Myiarchus crinitus</i>
Cassin's Kingbird	<i>Tyrannus vociferans</i>
Western Kingbird	<i>Tyrannus verticalis</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>
Purple Martin	<i>Progne subis</i>
Violet-green Swallow	<i>Tachycineta thalassina</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Bank Swallow	<i>Riparia riparia</i>
Cliff Swallow	<i>Hirundo pyrrhonota</i>
Cave Swallow	<i>Hirundo fulva</i>
Barn Swallow	<i>Hirundo rustica</i>
House Wren	<i>Troglodytes aedon</i>

Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>
Veery	<i>Catharus fuscescens</i>
Gray-cheeked Thrush	<i>Catharus minimus</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Phainopepla	<i>Phainopepla nitens</i>
White-eyed Vireo	<i>Vireo griseus</i>
Bell's Vireo	<i>Vireo bellii</i>
Black-capped Vireo	<i>Vireo atricapillus</i>
Gray Vireo	<i>Vireo vicinior</i>
Solitary Vireo	<i>Vireo solitarius</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>
Warbling Vireo	<i>Vireo gilvus</i>
Philadelphia Vireo	<i>Vireo philadelphicus</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Bachman's Warbler	<i>Vermivora bachmanii</i>
Blue-winged Warbler	<i>Vermivora pinus</i>
Golden-winged Warbler	<i>Vermivora chrysoptera</i>
Tennessee Warbler	<i>Vermivora peregrina</i>
Orange-crowned Warbler	<i>Vermivora celata</i>
Nashville Warbler	<i>Vermivora ruficapilla</i>
Virginia's Warbler	<i>Vermivora virginiae</i>
Lucy's Warbler	<i>Vermivora luciae</i>
Northern Parula	<i>Parula americana</i>
Yellow Warbler	<i>Dendroica petechia</i>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Magnolia Warbler	<i>Dendroica magnolia</i>
Cape May Warbler	<i>Dendroica tigrina</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>
Townsend's Warbler	<i>Dendroica townsendi</i>
Hermit Warbler	<i>Dendroica occidentalis</i>
Black-throated Green Warbler	<i>Dendroica virens</i>
Golden-cheeked Warbler	<i>Dendroica chrysoparia</i>
Blackburnian Warbler	<i>Dendroica fusca</i>
Yellow-throated Warbler	<i>Dendroica dominica</i>
Grace's Warbler	<i>Dendroica graciae</i>
Kirtland's Warbler	<i>Dendroica kirtlandii</i>
Prairie Warbler	<i>Dendroica discolor</i>
Palm Warbler	<i>Dendroica palmarum</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>
Blackpoll Warbler	<i>Dendroica striata</i>
Cerulean Warbler	<i>Dendroica cerulea</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
American Redstart	<i>Setophaga ruticilla</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Worm-eating Warbler	<i>Helmitheros vermivorus</i>
Swainson's Warbler	<i>Limnithlypis swainsonii</i>
Ovenbird	<i>Seiurus auricapillus</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Connecticut Warbler	<i>Oporornis agilis</i>
Mourning Warbler	<i>Oporornis philadelphia</i>
MacGillivray's Warbler	<i>Oporornis tolmiei</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Red-faced Warbler	<i>Cardellina rubrifrons</i>
Painted Redstart	<i>Myioborus pictus</i>
Yellow-breasted Chat	<i>Icteria virens</i>
Olive Warbler	<i>Peucedramus taeniatus</i>
Hepatic Tanager	<i>Piranga flava</i>
Summer Tanager	<i>Piranga rubra</i>

Scarlet Tanager  
 Western Tanager  
 Rose-breasted Grosbeak  
 Black-headed Grosbeak  
 Blue Grosbeak  
 Lazuli Bunting  
 Indigo Bunting  
 Varied Bunting  
 Painted Bunting  
 Dickcissel  
 Green-tailed Towhee  
 Chipping Sparrow  
 Clay-colored Sparrow  
 Brewer's Sparrow  
 Black-chinned Sparrow  
 Lark Sparrow  
 Lark Bunting  
 Baird's Sparrow  
 Grasshopper Sparrow  
 Lincoln's Sparrow  
 Bobolink  
 Yellow-headed Blackbird  
 Bronzed Cowbird  
 Orchard Oriole  
 Hooded Oriole  
 Northern Oriole  
 Scott's Oriole

*Piranga olivacea*  
*Piranga ludoviciana*  
*Pheucticus ludovicianus*  
*Pheucticus melanocephalus*  
*Guiraca caerulea*  
*Passerina amoena*  
*Passerina cyanea*  
*Passerina versicolor*  
*Passerina ciris*  
*Spiza americana*  
*Pipilo chlorurus*  
*Spizella passerina*  
*Spizella pallida*  
*Spizella breweri*  
*Spizella atrogularis*  
*Chondestes grammacus*  
*Calamospiza melanocorys*  
*Ammodramus bairdii*  
*Ammodramus savannarum*  
*Melospiza lincolni*  
*Dolichonyx oryxivorus*  
*Xanthocephalus xanthocephalus*  
*Molothrus aeneus*  
*Icterus spurius*  
*Icterus cucullatus*  
*Icterus galbula*  
*Icterus parisorum*

=====

Appendix B. Short-term (10-year) and long-term (26-year) priority ranking for each species from the Colorado Bird Observatory (Sample of complete data set from diskette)

Bird Species	CBO Priority Ranking	
	10-year	26-year
American Swallow-tailed Kite	22	22
Mississippi Kite	20	19
Common Black-Hawk	19	19
Broad-winged Hawk	15	16
Swainson's Hawk	16	17
Zone-tailed Hawk	17	17
Merlin	16	16
.		
.		
Scott's Oriole	19	17

Appendix C. Breeding species present (with at least 25% overlap) in each ecoregion (Sample of complete data set from diskette)

0 indicates absence  
1 indicates presence

Bird Species	Breeding Ecoregion							43
	1	2	3	4	5	6	7	
American Swallow-tailed Kite	0	0	0	0	0	0	0	1
Mississippi Kite	0	0	0	0	0	0	0	0
Common Black-Hawk	0	0	0	0	0	0	0	1
Broad-winged Hawk	0	0	0	0	0	0	0	0
Swainson's Hawk	0	0	0	1	1	0	1	0
Zone-tailed Hawk	0	0	0	0	0	0	0	1
Merlin	1	1	1	1	1	1	1	0
.								
Scott's Oriole	0	0	0	0	0	0	0	0

Appendix D. Wintering species present (with at least 25% overlap) in each ecoregion (Sample of complete data set from diskette)

0 indicates absence  
1 indicates presence

Bird Species	Wintering Ecoregion							112
	21	22	23	24	25	26	27	
American Swallow-tailed Kite	0	0	0	0	0	0	0	0
Mississippi Kite	0	0	0	0	0	0	0	0
Common Black-Hawk	0	0	0	1	0	0	1	0
Broad-winged Hawk	0	0	0	0	0	0	0	0
Swainson's Hawk	0	0	0	0	0	0	0	0
Zone-tailed Hawk	0	0	0	1	1	0	1	0
Merlin	1	1	1	1	1	1	1	0
.								
Scott's Oriole	0	0	0	1	0	0	1	0

Appendix E. Number of species in common between breeding and wintering ranges by ecoregion (Sample of complete data set from diskette)

Breeding Ecoregion	Wintering Ecoregion							112
	21	22	23	24	25	26	27	
1	4	5	4	5	4	4	5	2
2	4	5	5	6	4	4	6	2
3	5	6	8	9	6	5	9	3
4	5	5	8	9	6	5	8	3
5	4	4	4	4	4	4	4	2
6	2	2	2	2	2	2	2	1
7	5	5	8	9	5	4	9	2
.								
43	3	2	7	12	7	4	13	0

# Ecoregions of North and Central America

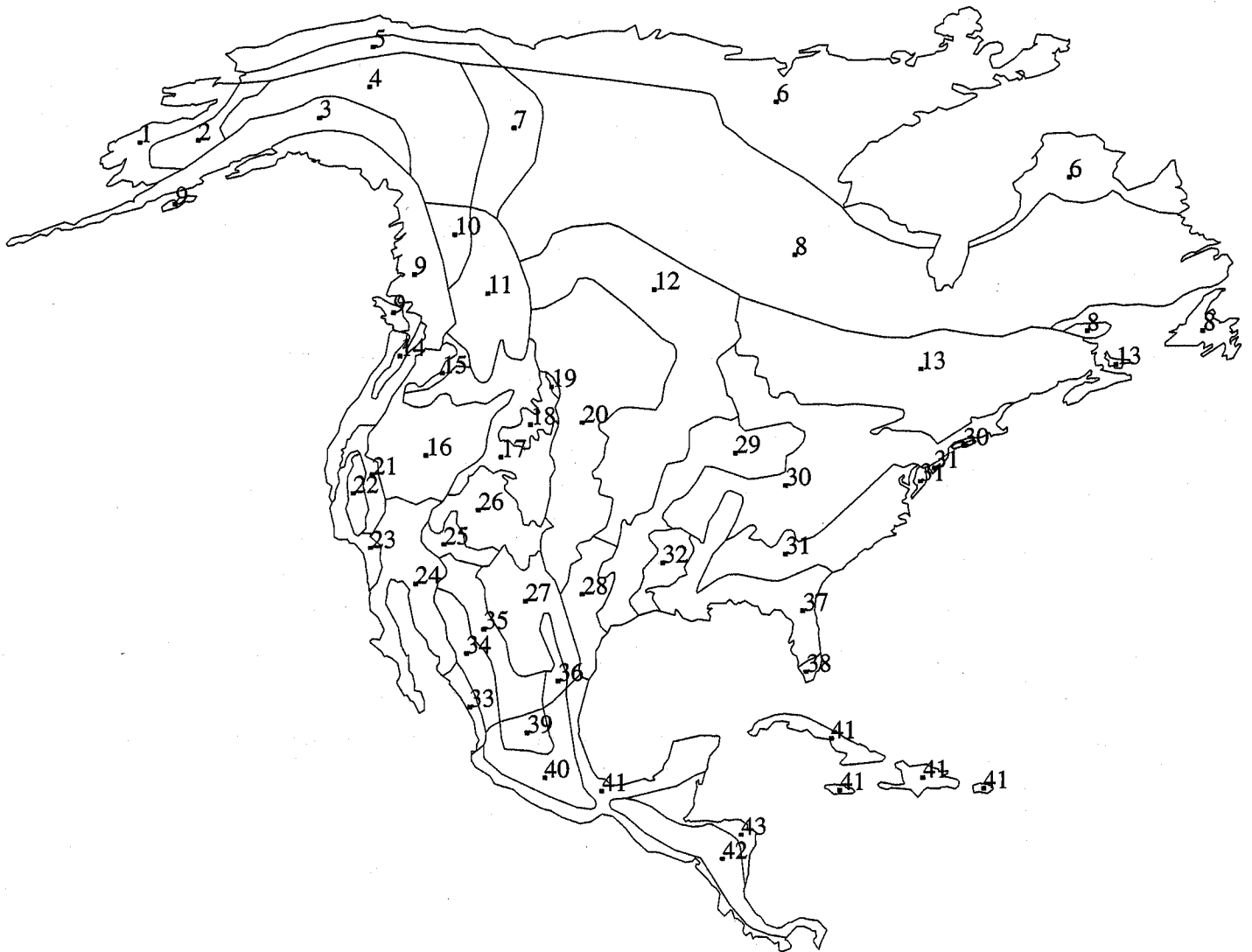


Figure 1

# Ecoregions of South America

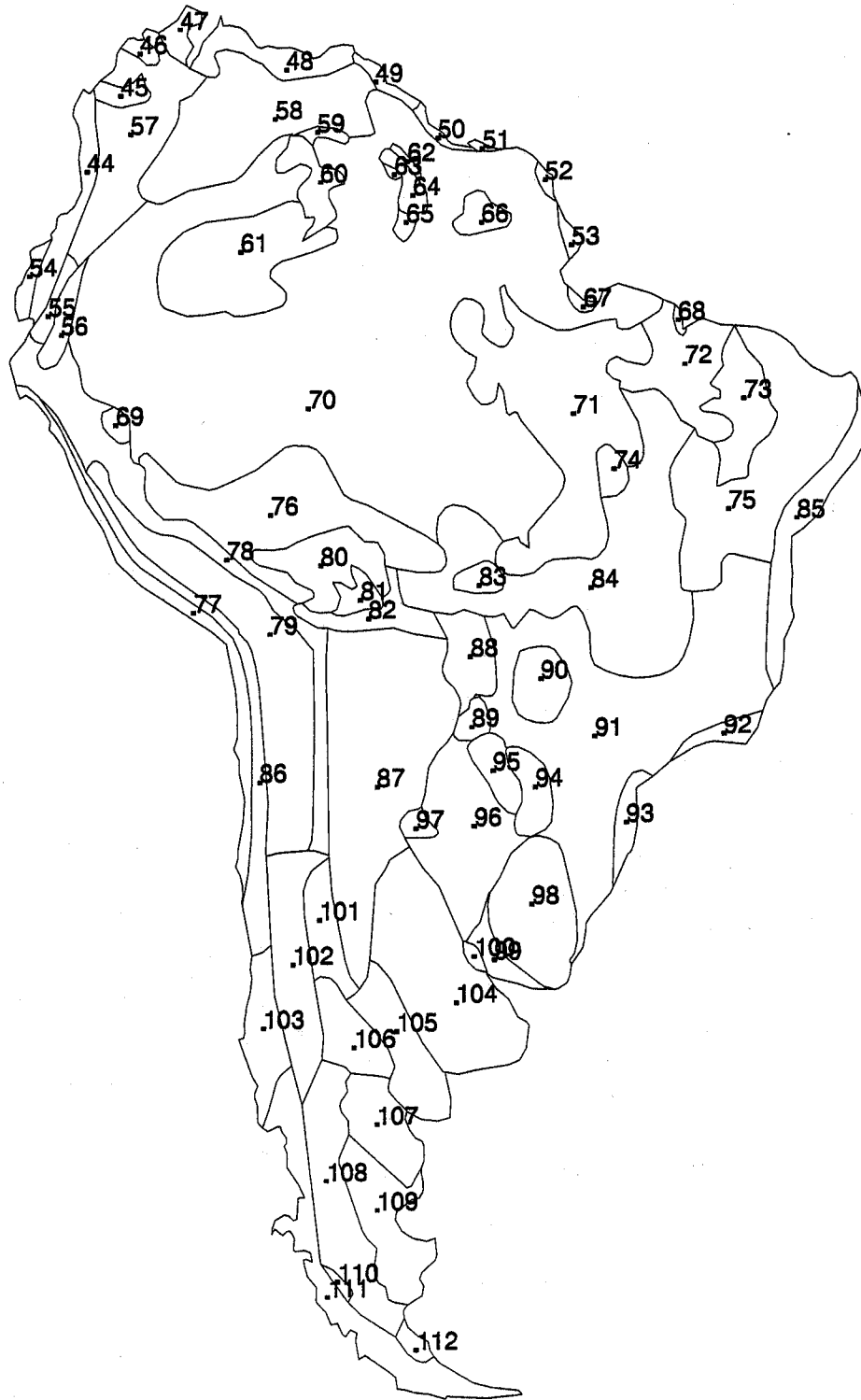


Figure 2

# Locations of Potential Sister Forest Pairings Between the US and Mexico

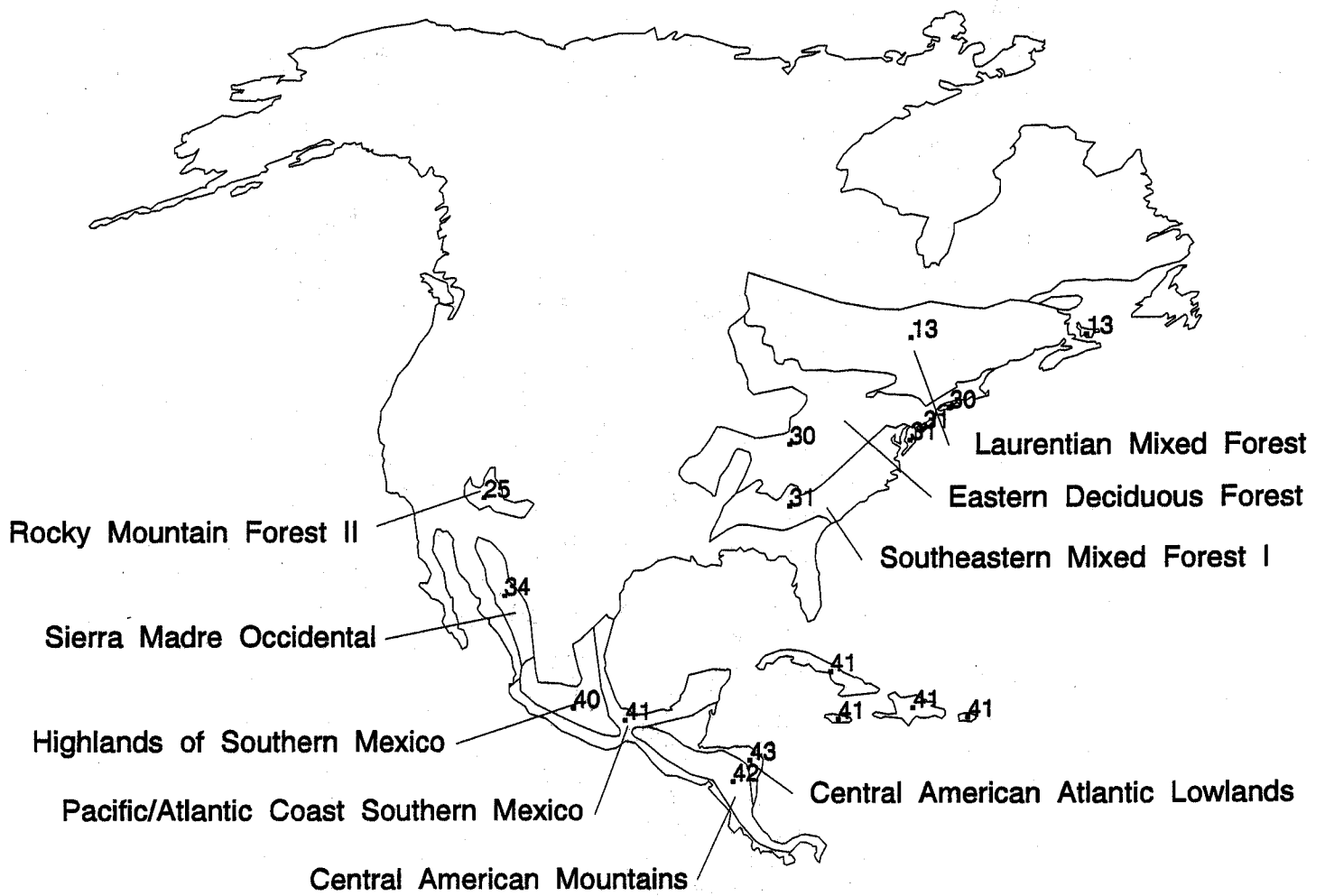


Figure 3

# Breeding and Wintering Ranges of the Western Tanager

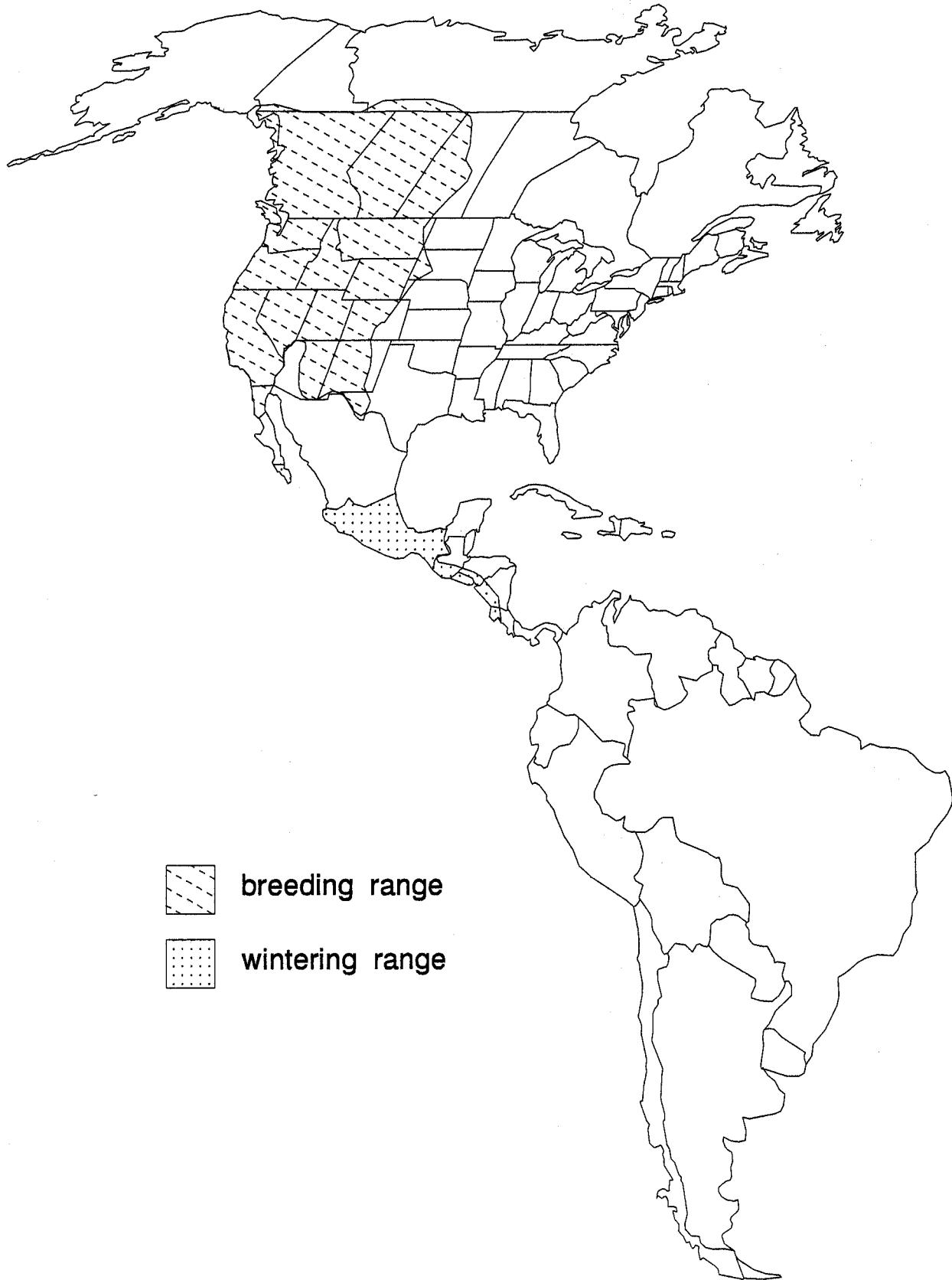


Figure 4

# Breeding and Wintering Ranges of the Golden-winged Warbler

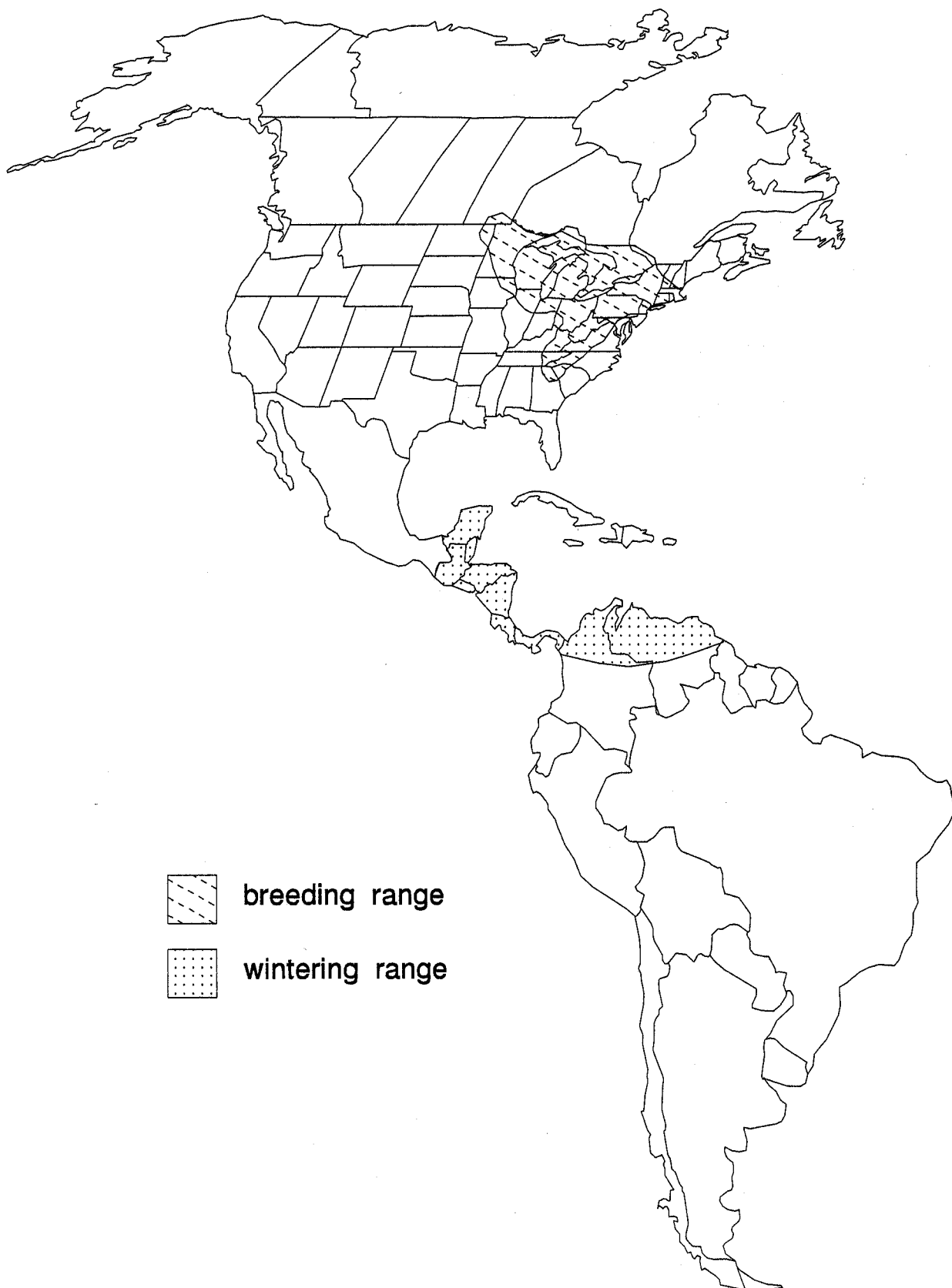


Figure 5

# Density of Species per Ecoregion in the Breeding Ranges of Neotropical Migrants

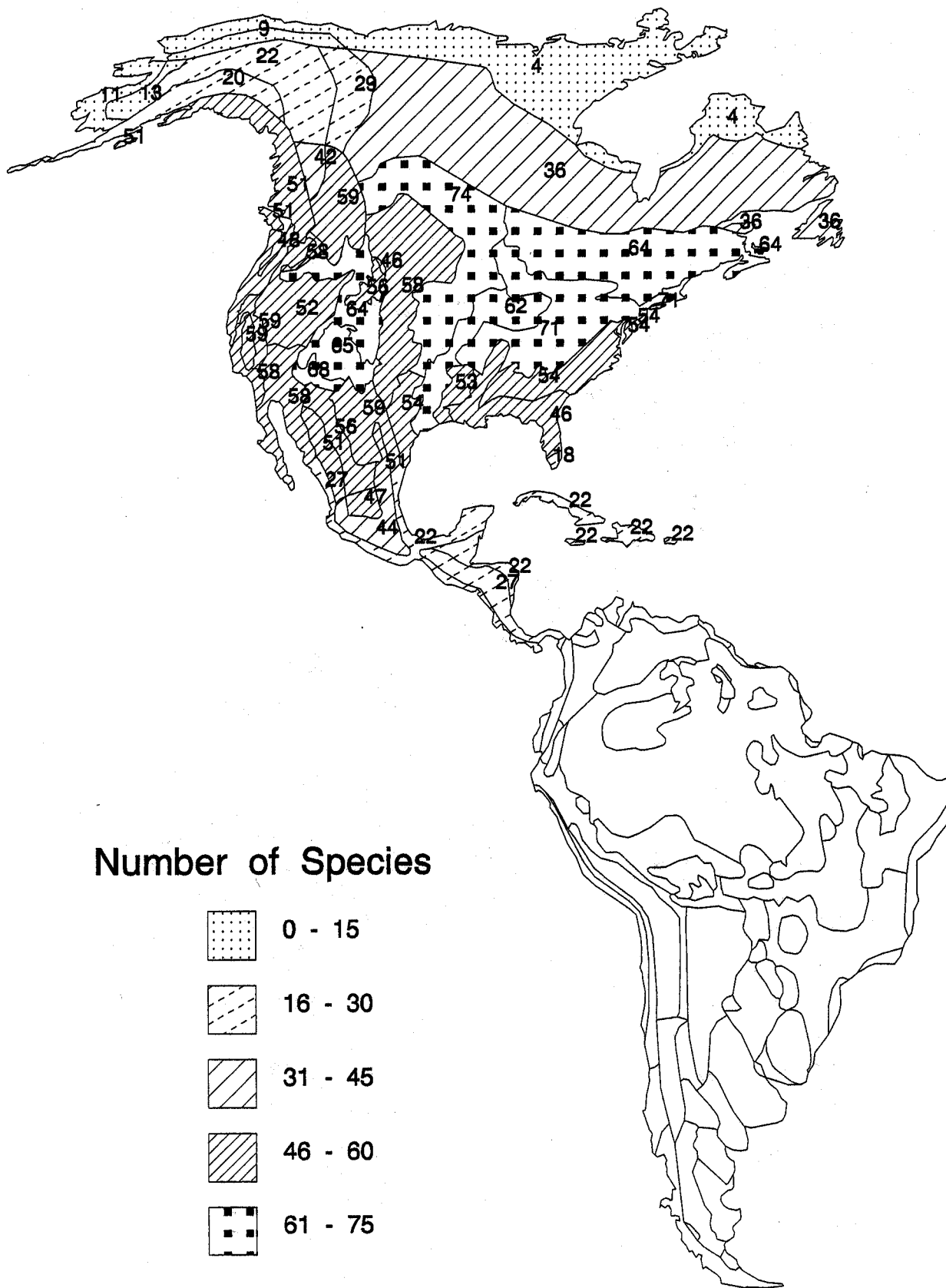


Figure 6

# Density of Species per Ecoregion in the Wintering Ranges of Neotropical Migrants

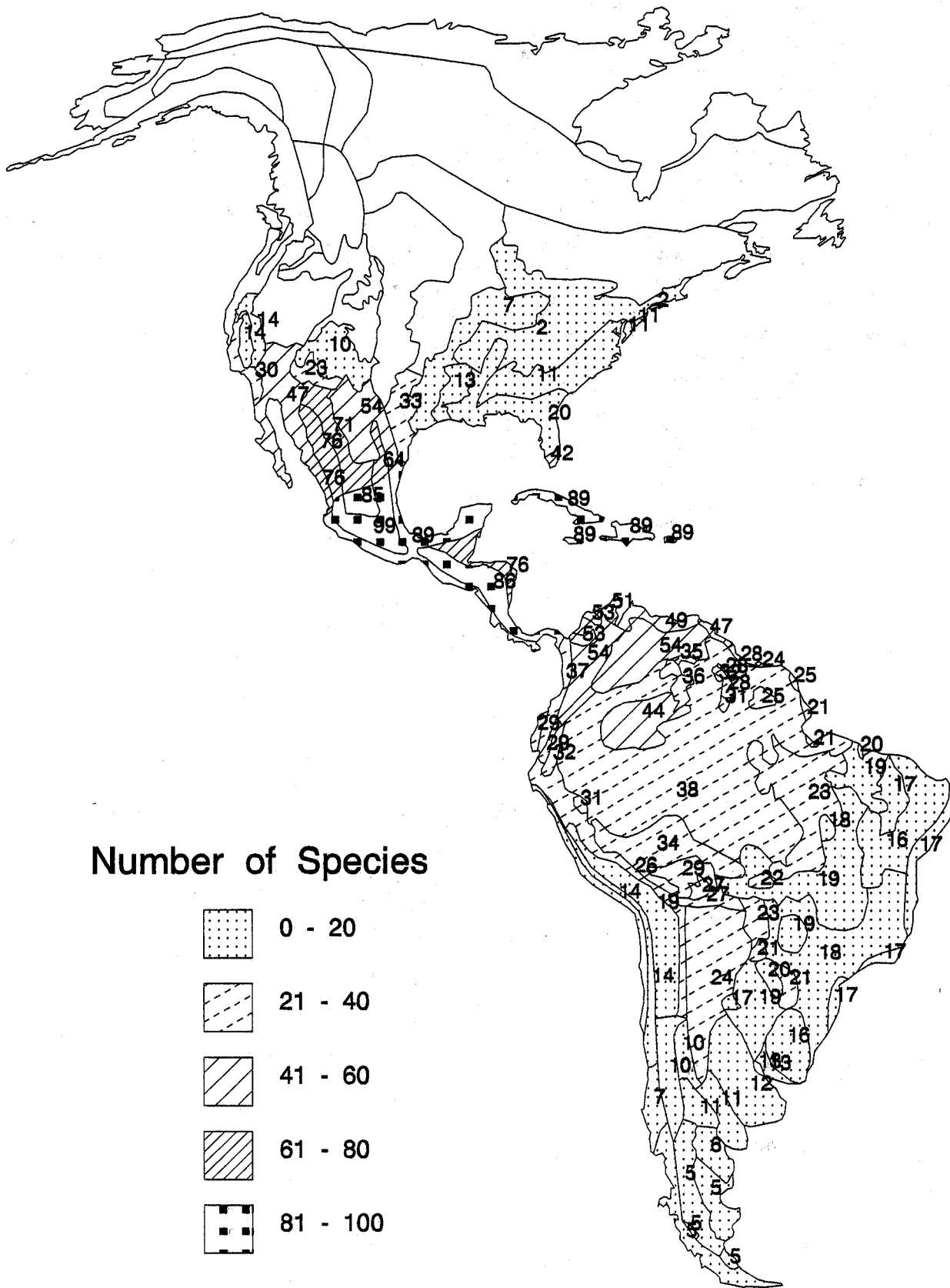


Figure 7

# Weighted Density of Species per Ecoregion in the Breeding Ranges of Neotropical Migrants

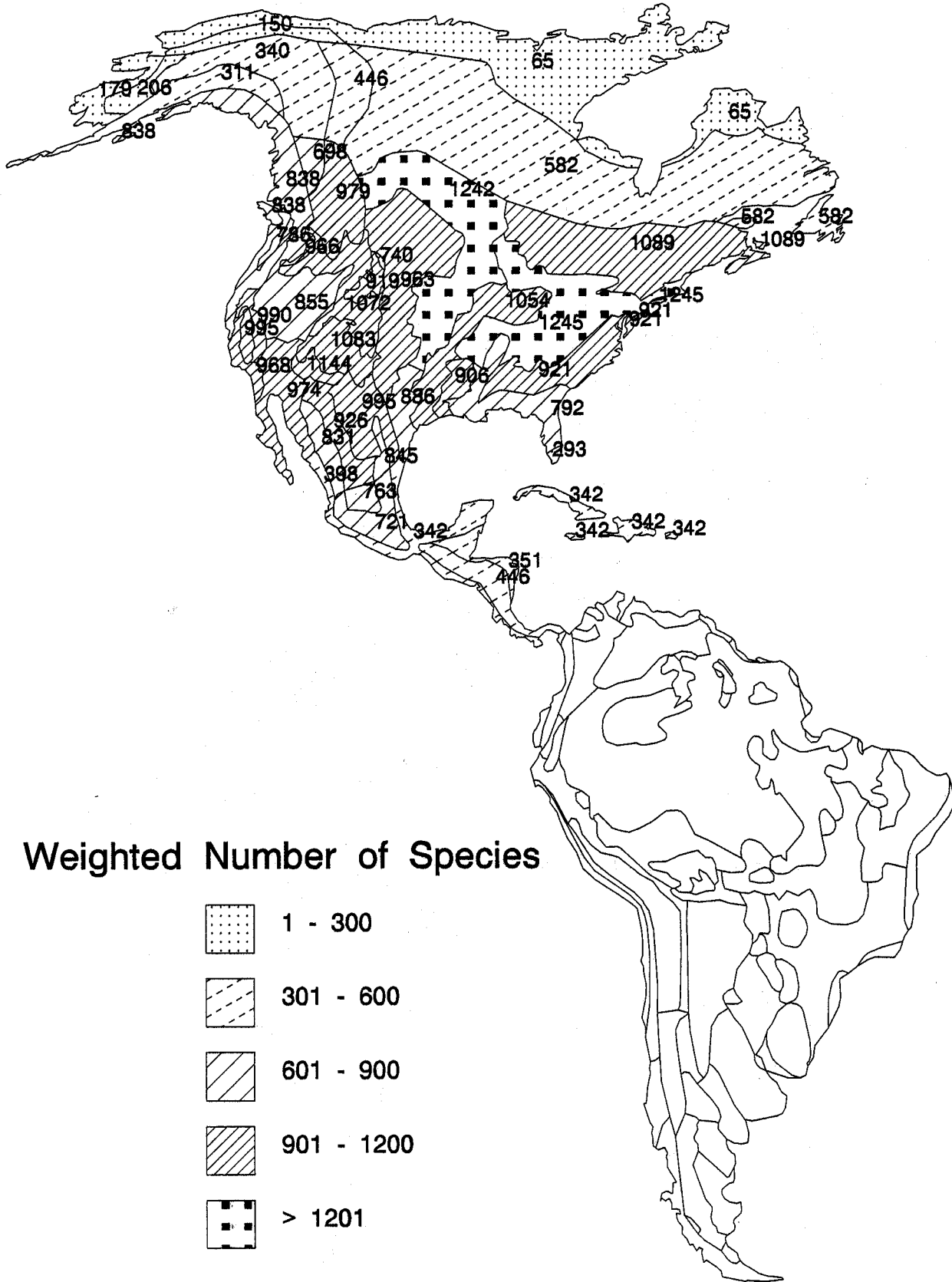


Figure 8

# Weighted Density of Species per Ecoregion in the Wintering Ranges of Neotropical Migrants

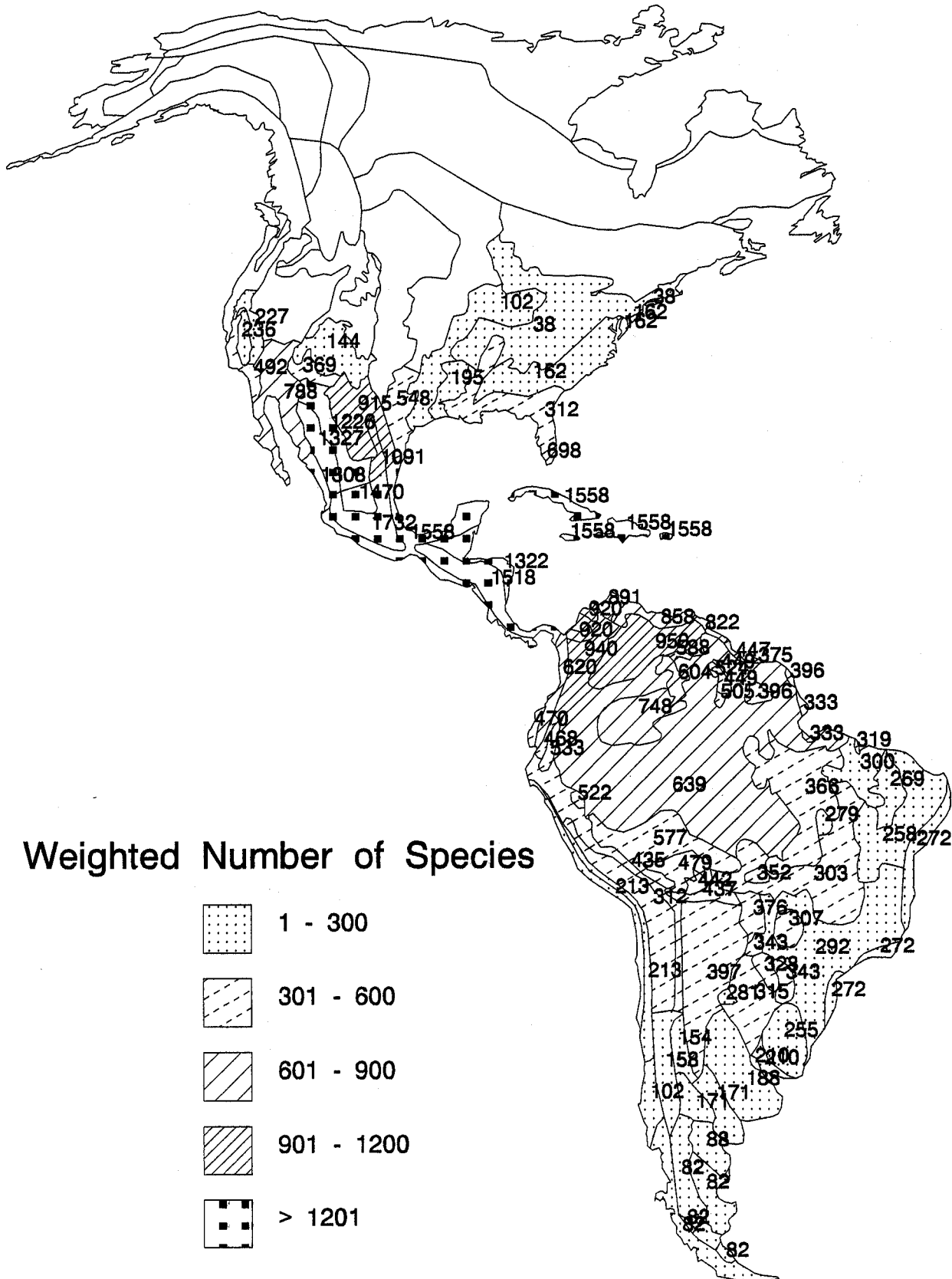


Figure 9

# Breeding Ranges of Neotropical Migrants That Winter in Latin America

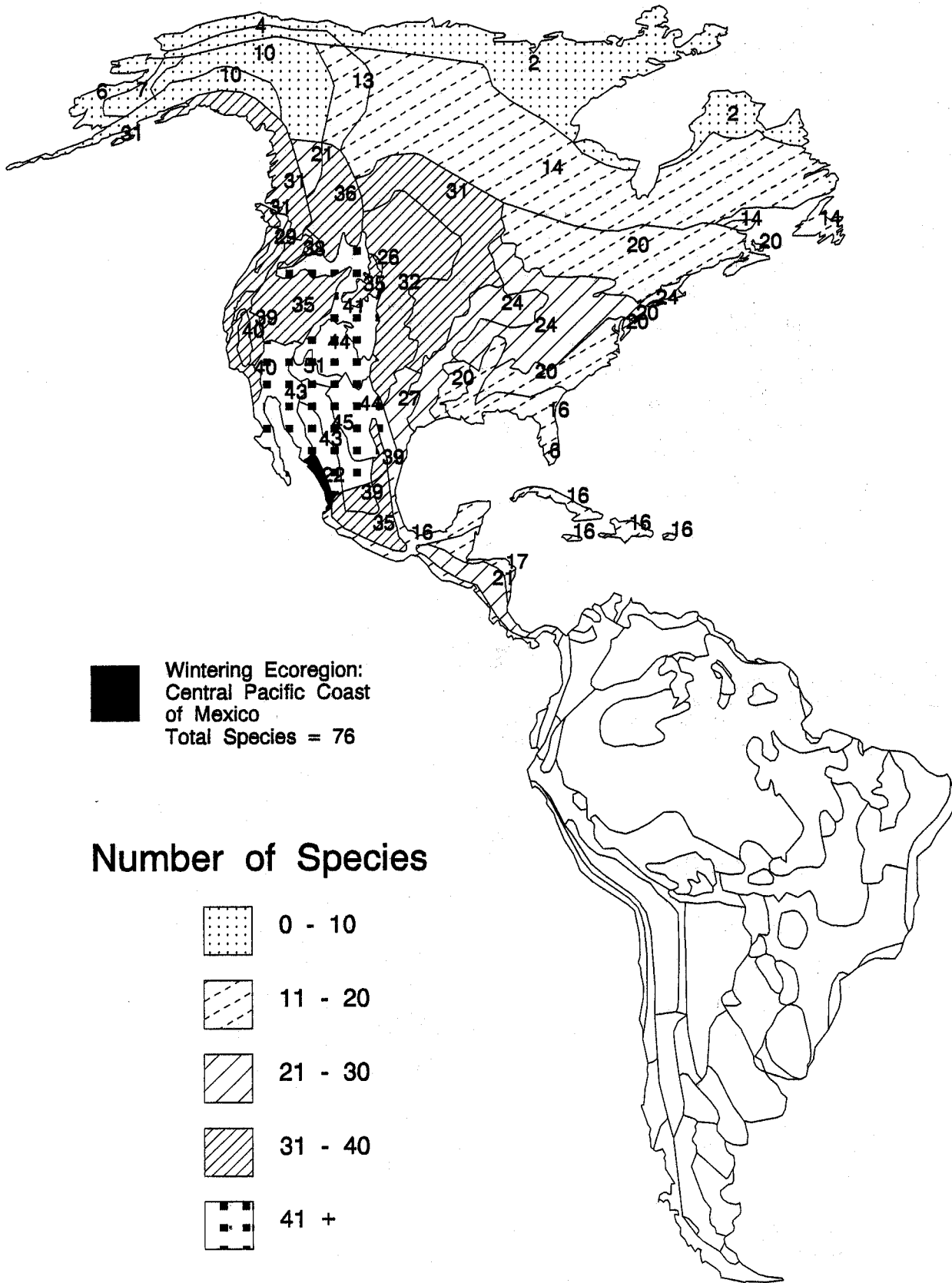


Figure 10

# Breeding Ranges of Neotropical Migrants That Winter in Latin America

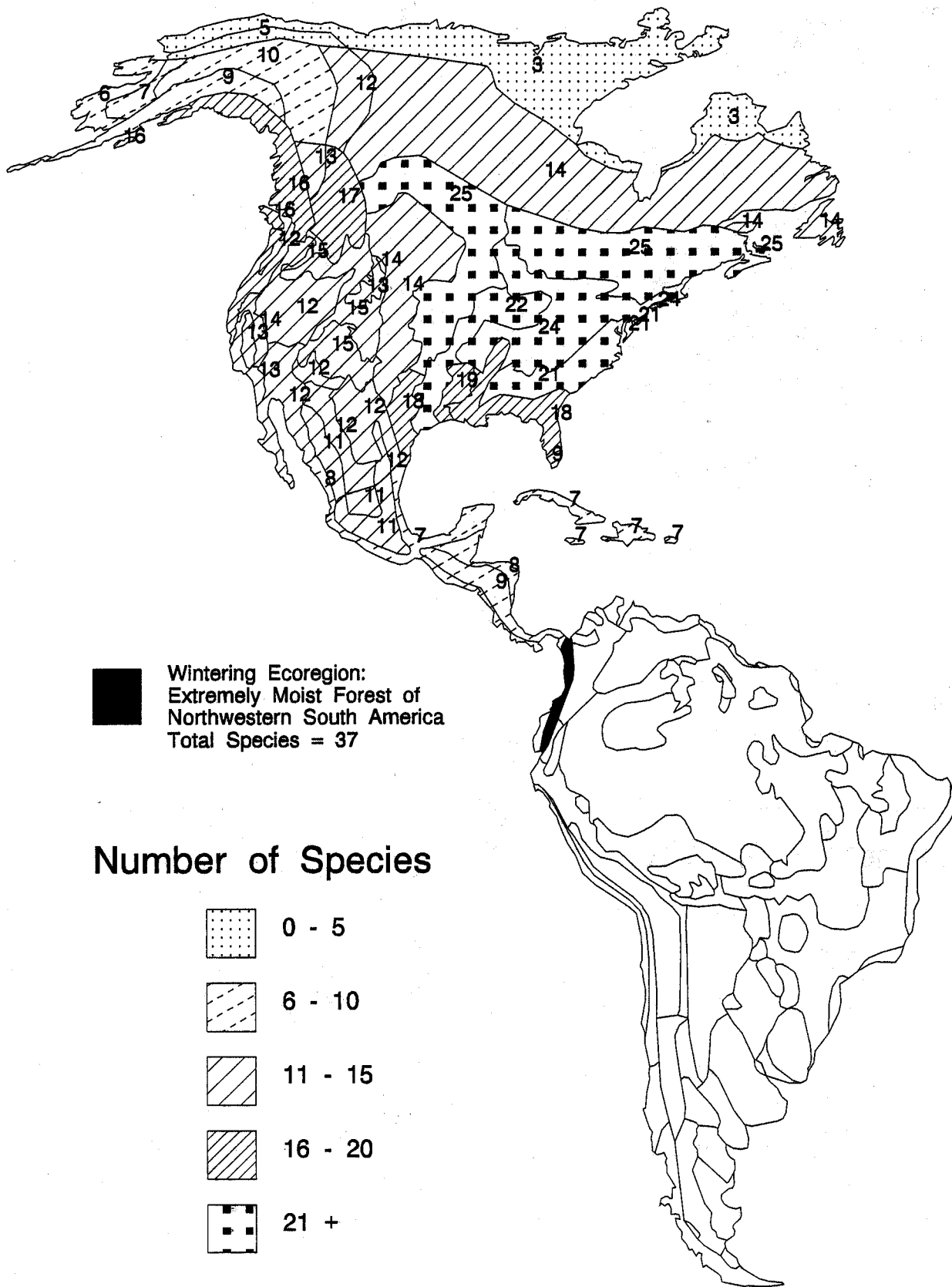


Figure 11

# Wintering Ranges of Neotropical Migrants That Breed in North America

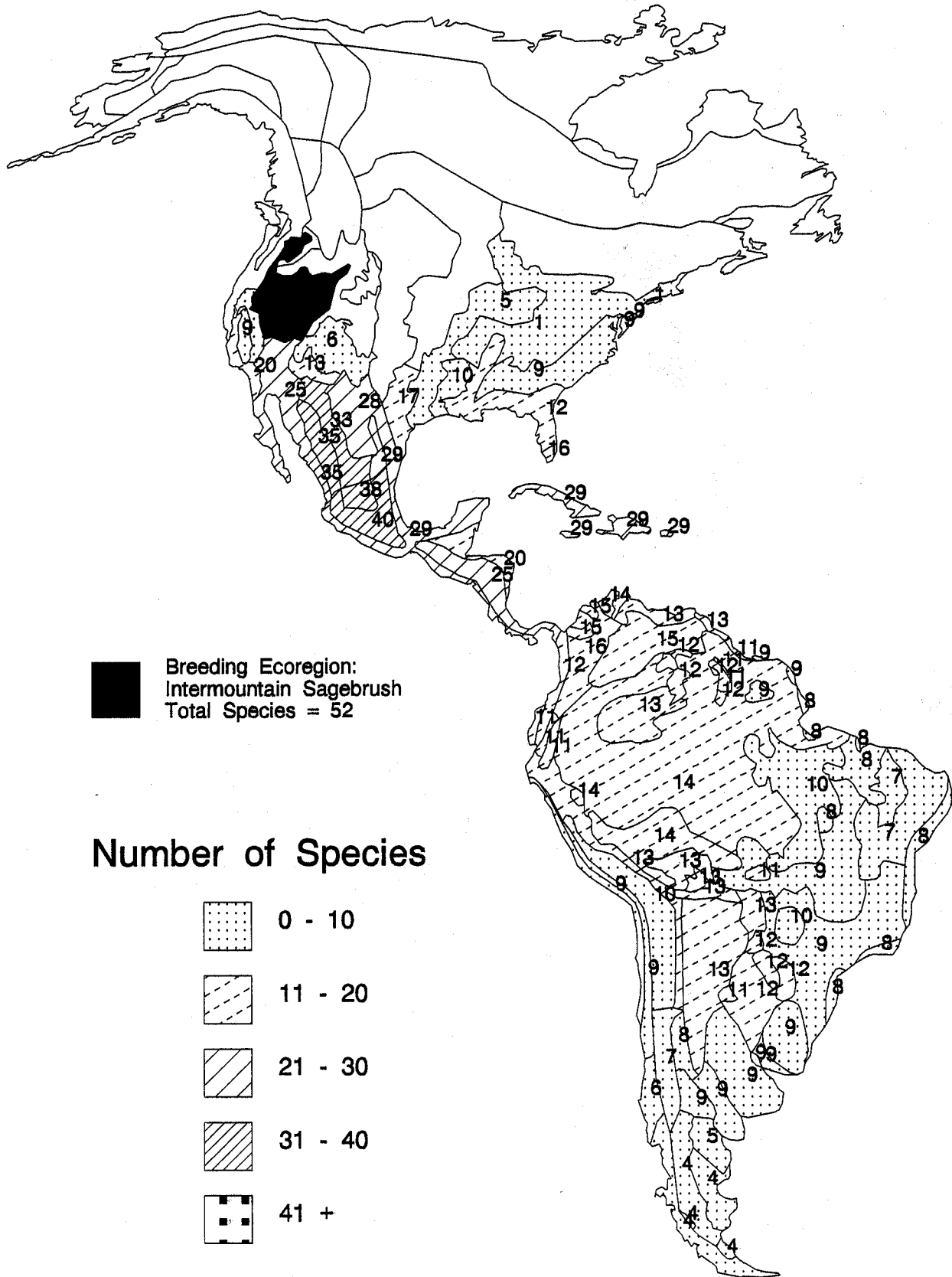


Figure 12

# Wintering Ranges of Neotropical Migrants That Breed in North America

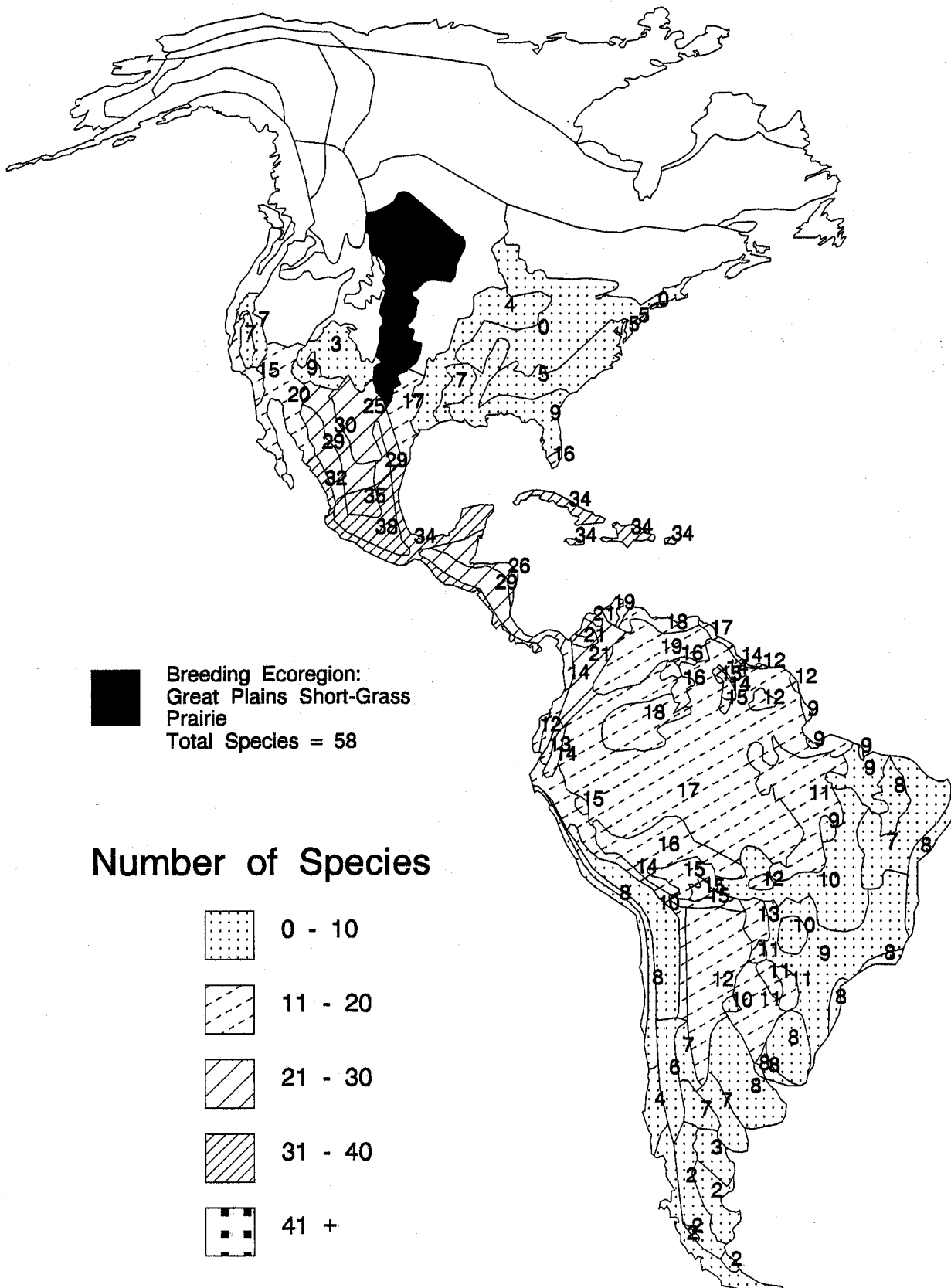


Figure 13

# Wintering Ranges of Neotropical Migrants That Breed in North America

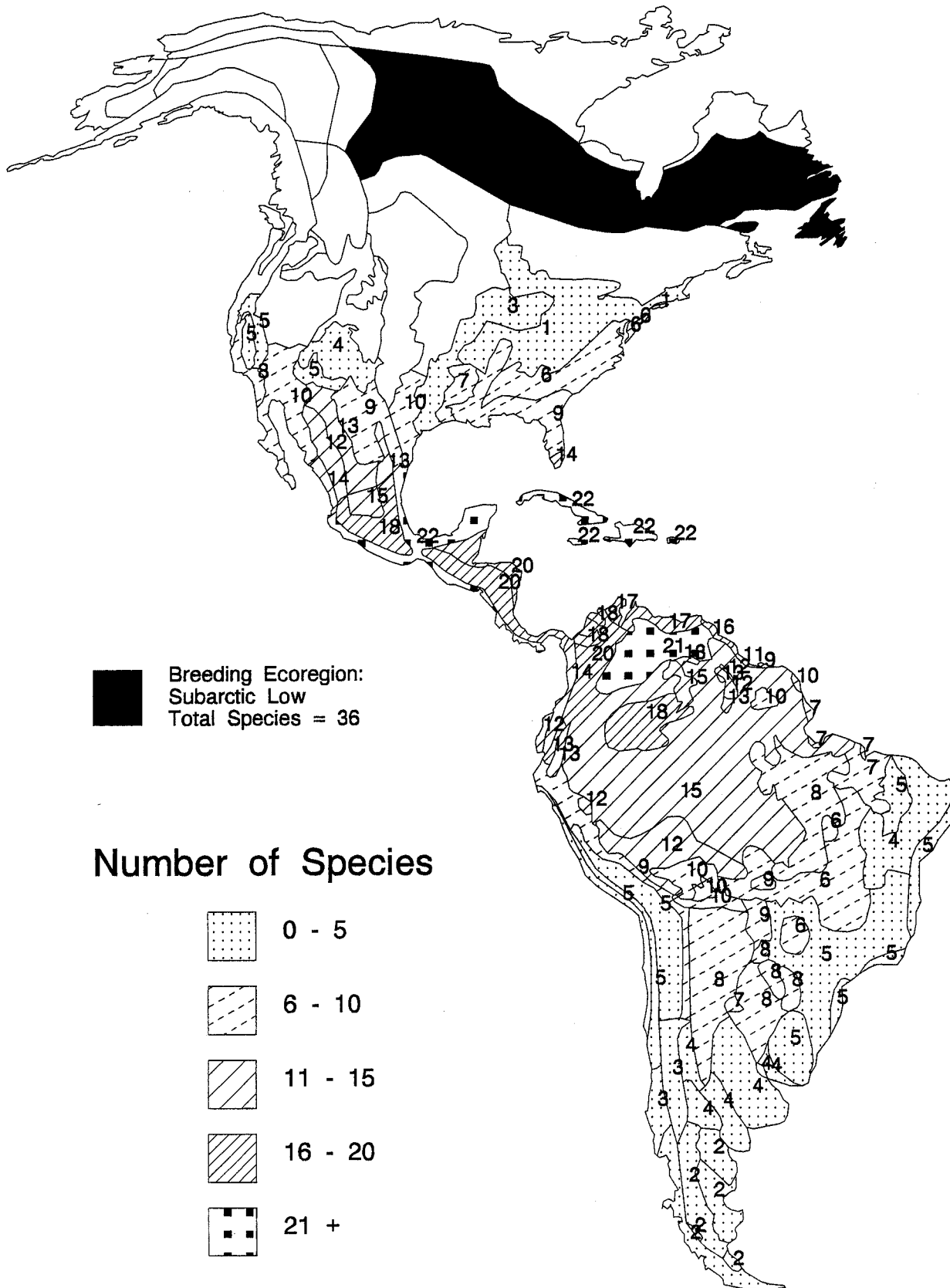


Figure 14

# Wintering Ranges of Neotropical Migrants That Breed in North America

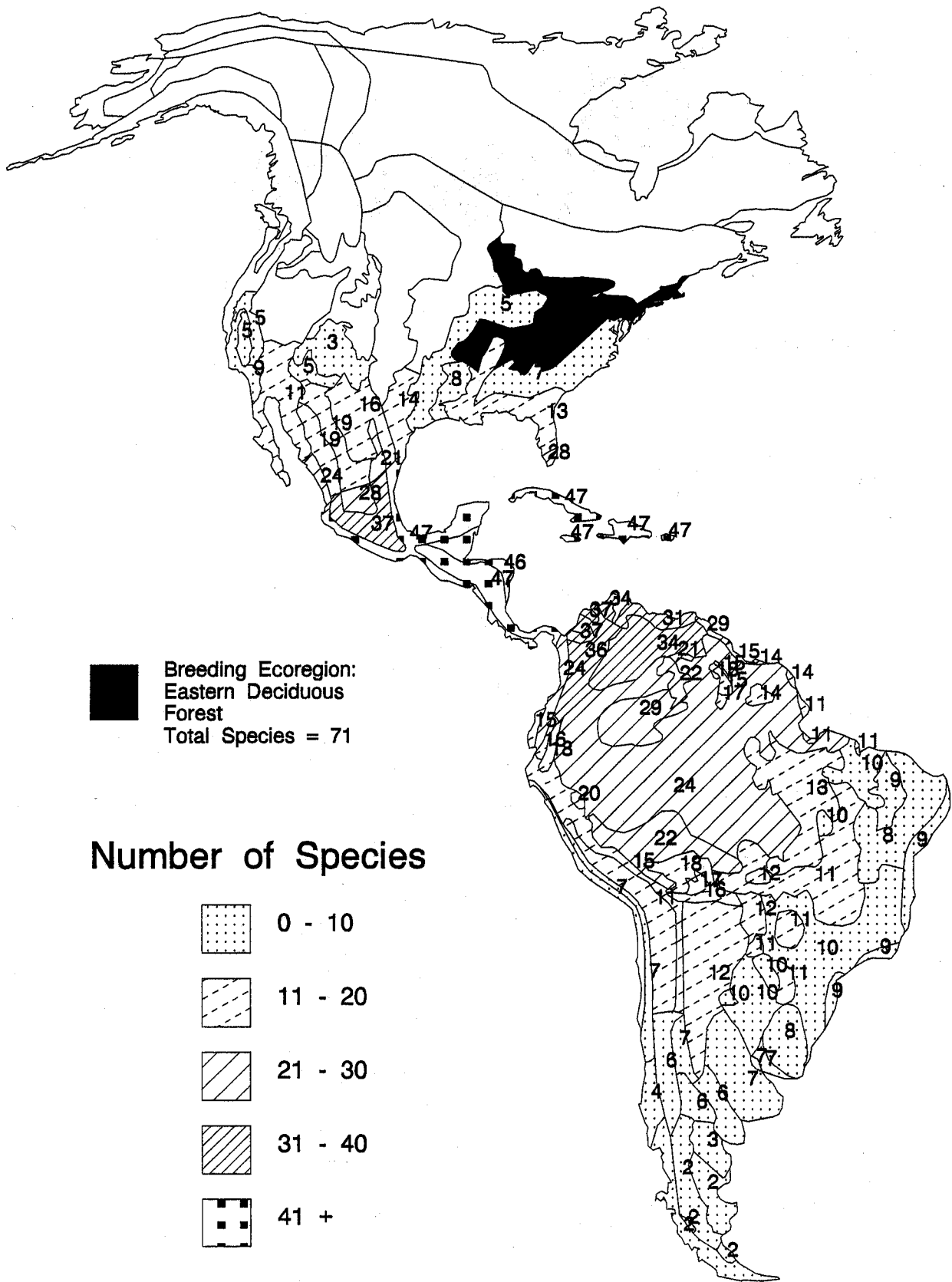


Figure 15