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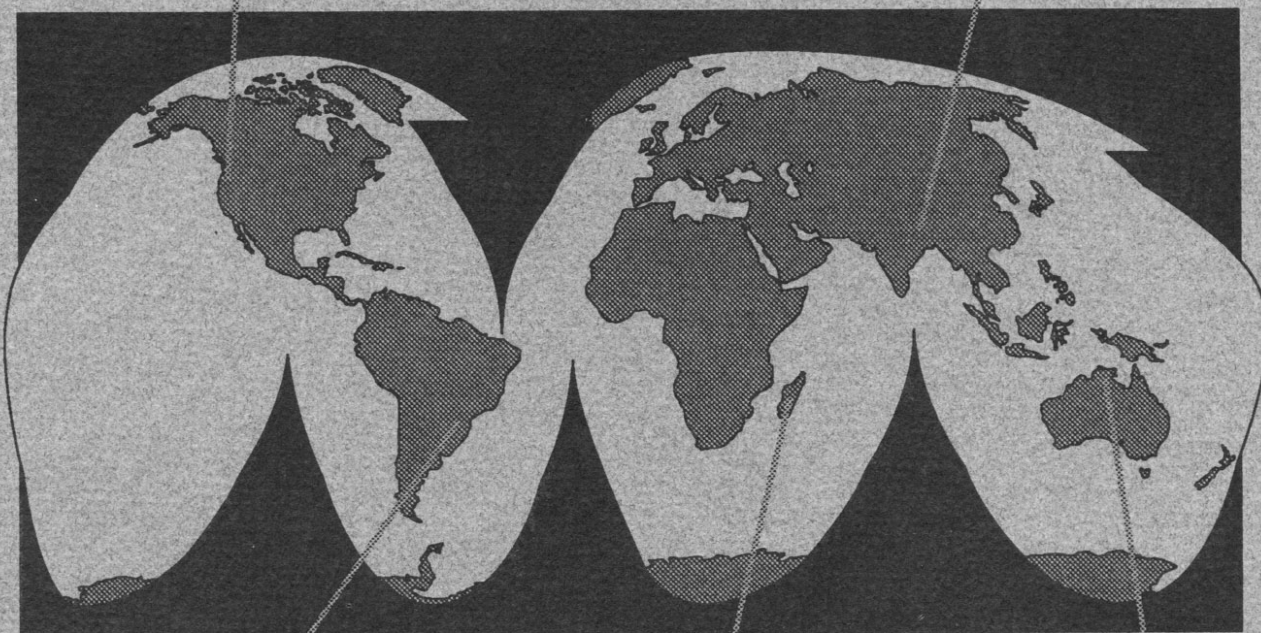
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# Owls of Old Forests of the World

Bruce G. Marcot





## Cover

The cover illustrates a few selected species of owls found in old forests of the world. Clockwise from upper left: in conifer forests of North America is the Northern Spotted Owl (*Strix accidentalis caurina*); in dense evergreen forests of Southeast Asia is the Bay Owl (*Phodilus badius*); in rain forests of Australia is the Rufous Owl (*Ninox rufa*); in dense evergreen rain forests of Madagascar is the Soumagne's Owl (*Tyto soumagnei*); and in Neotropical lowland forests of South America is the White-Chinned or Tawny-browed Owl (*Pulsatrix koeniswaldiana*).

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## Abstract

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A review of literature on habitat associations of owls of the world revealed that about 83 species of owls among 18 genera are known or suspected to be closely associated with old forests. Old forest is defined as old-growth or undisturbed forests, typically with dense canopies. The 83 owl species include 70 tropical and 13 temperate forms. Specific habitat associations have been studied for only 12 species (7 tropical and 5 temperate), whereas about 71 species (63 tropical and 8 temperate) remain mostly unstudied. Some 26 species (31 percent of all owls known or suspected to be associated with old forests in the tropics) are entirely or mostly restricted to tropical islands. Threats to old-forest owls, particularly the island forms, include conversion of old upland forests, use of pesticides, loss of riparian gallery forests, and loss of trees with cavities for nests or roosts. Conservation of old-forest owls should include (1) studies and inventories of habitat associations, particularly for little-studied tropical and insular species; (2) protection of specific, existing temperate and tropical old-forest tracts; and (3) studies to determine if reforestation and vegetation manipulation can restore or maintain habitat conditions. An appendix describes vocalizations of all species of *Strix* and the related genus *Ciccaba*.

**Keywords:** Owls, old growth, old-growth forest, late-successional forests, spotted owl, owl calls, owl conservation, tropical forests, literature review.

## Summary

To better understand the broader context of conservation strategies developed for the Northern Spotted Owl in the Pacific Northwest of the United States, this paper reviews the status and management of owls associated with old, closed-canopy, or undisturbed temperate and tropical forests throughout the world.

A total of 83 extant owl species are associated with old forests. Twelve of these species (seven tropical or subtropical and five temperate) are fairly well known to be closely associated mostly with dense, old, or undisturbed forests. Examples include Soumagne's Owl of dense, evergreen rain forests of Madagascar; the Bay Owl of Himalayan forests; the Northern Spotted Owl of the Pacific Northwest, and its cousin the Himalayan Wood Owl of eastern Himalayas oak and conifer forests; and the Crested Owl of dense forests of the Neotropics (figs. 22, 23). The remaining 71 species (63 tropical and 8 temperate) are associated with, and may be dependent on, old forests but are essentially unstudied.

Basic inventories and ecological studies of habitat associations of many of these 83 species are needed. Priority should be given for species in isolated, insular, or increasingly fragmented environments (for example, Celebes Barn Owl and Giant Scops Owl) whose primary old-forest habitat is threatened and in decline, as it is with many of the tropical species (for example, Scully's Wood Owl and Fulvous Owl; see figs. 12, 13).

Nearly a third of the 83 species occur on islands or peninsulas, and the remainder are found in continental settings. The island forms are often at relatively higher risk of population decline and extinction. At least six owl species recently extinct likely were associated with old forests; five of these occurred on islands.

The greatest threat to owls of old forests is the direct loss of their habitats. One example is the loss in recent decades of old, dense, interior forest habitat of wet evergreen and moist deciduous forests in the Indo-Malayan area, which has caused declines in populations of Brown Wood Owls and Bay Owls. Other threats, particularly to island forms, include conversion of older upland secondary forests, use of pesticides, loss of riparian gallery forests, loss of trees with cavities for nests or roosts, and tourism and other human disturbance.

No scientific studies have demonstrated to date that forestry can be used to restore old-forest habitats and associated owl populations. In the Pacific Northwest, however, silvicultural studies are underway to test how well old-forest components, such as large live trees, large snags and down logs, and dense and diverse vegetation structures, can be maintained intentionally or induced by direct stand manipulation. One phase of these studies involves testing behavioral and population responses by the Northern Spotted Owl in National Forests. Restoration projects elsewhere, as in Costa Rica and India, might help identify useful silvicultural methods to recover local populations and habitats of old-forest owls, but much work still is needed.

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## Introduction

The Northern Spotted Owl (*Strix occidentalis caurina*) has been the center of recent controversies over conservation of ancient forests in the Pacific Northwest of the United States. Globally, however, it is not the only owl species associated with old-forest habitats. This paper reviews species of owls associated with old temperate and tropical forests throughout the world.

Although other authors (for example, Clark and others 1987) have summarized occurrence of some owl species by general forest types, none has done so for old forests and with a global perspective. This report discusses owl species closely associated with old, dense, or undisturbed forests, particularly species with populations or habitats declining in abundance or distribution. I generally follow taxonomies presented in Everett (1977), Clark and others (1978), Amadon and Bull (1988), and Voous (1988). Scientific names of all old-forest owls are listed in table 1. Scientific names of selected subspecies and species are included in the text for clarity or for species not closely associated with old forests.

I do not discuss all species of owls found in forested habitats. I list species associated with dense, old-forest conditions in two categories: (1) species whose associations with such forests have been documented by primary scientific autecological studies, and (2) those without studies but with anecdotal accounts suggesting close association. I also denote species (1) whose ranges primarily occur in tropical latitudes ("tropical") and (2) those mostly in temperate latitudes or in high-elevation temperate forest habitats in tropical latitudes ("temperate"). As a point of comparison, I also discuss some species that seem to inhabit other forest conditions successfully and that can coexist in human-altered landscapes. I hope that this review will lead to a broader understanding and better informed decisions on managing old-forest habitats, such as those for the Northern Spotted Owl in the Western United States.

## Owls of Old Forests of the World

It is not unusual for forest-dwelling wildlife species to exhibit specific affinities and adaptations for old- or undisturbed-forest environments. In many ways, much of the wildlife of the world evolved in association with vegetation and environments unaltered by human presence. This is also true with owls. Some owls have persisted in spite of persecution by humans, such as the Great Horned Owl (*Bubo virginianus*), or have successfully adapted to use of buildings and human habitations, such as the Barn Owl (*Tyto alba*). Others, including the Eurasian Eagle-Owl (*Bubo bubo*), have been extirpated throughout much of their previous range (Clark 1987, Clark and others 1978, Fremming 1987; see fig. 26) but have persisted in areas of rather sparse human presence. Such persistence indicates the extent to which some owl species can tolerate additional habitat change. Many owl species have retained their close affinities with the old forests in which they likely evolved (table 1) and have suffered great declines because of habitat alteration.

Ecologies of most owl species are little known. Habitats, particularly of forest owl species, seldom are described in details of forest age, structure, flora, or degree of disturbance. Thus, in this report, "old forest" refers to various conditions, particularly (1) closed-canopy forests (which often denotes undisturbed, mature or old-growth forests); and (2) forested stands and landscapes little disturbed by human activities, especially timber harvests, human settlements, agriculture, and human-caused fires.

**Table 1-Owls primarily associated with old tropical or temperate forests<sup>a</sup>**

| Species  | Tropical <sup>b</sup> | Temperate <sup>b</sup> | Range, habitat                            |
|--|-----------------------|------------------------|---|
| <i>Tyto</i> , Barn Owls and relatives:   |                       |                        |   |
| Celebes Barn Owl ( <i>T. rosenbergii</i> )   | ?                     |                        | Celebes rain forest                       |
| Sooty Owl ( <i>T. tenebricosa</i> )-   | ?                     |                        | Australia                                 |
| Lesser Sooty Owl ( <i>T. multipunctata</i> ) (recently listed as separate species) | ?                     |                        | Northeast Queensland                      |
| Soumagne's Owl ( <i>T. soumagnei</i> )   | x                     |                        | Madagascar dense evergreen rain forest    |
| Sula Island Barn Owl ( <i>T. nigrobrunnea</i> )                                    | ?                     |                        | Indonesia                                 |
| Minahassa Barn Owl ( <i>T. inexpectata</i> )                                       | ?                     |                        | Indonesia                                 |
| <i>T. pollens</i> (extinct)  | (?)                   |                        | Bahamas pine barrens                      |
| <i>Phodilus</i> , Bay Owls:  |                       |                        |   |
| Bay Owl ( <i>P. badius</i> )   | x                     |                        | Himalayas dense evergreen forest          |
| Prigogine's Owl or African bay owl ( <i>P. prigoginei</i> )                        | ?                     |                        | Congo montane forest                      |
| <i>Otus</i> , Scops Owls:  |                       |                        |   |
| Spotted Scops Owl ( <i>O. spilocephalus spilocephalus</i> )-                       |                       | ?                      | Southeast Asia evergreen forest           |
| Javan Scops Owl ( <i>O. s. angelinae</i> ) <sup>c</sup>                            | ?                     |                        | Java mountain forests                     |
| White-Fronted Scops Owl ( <i>O. sagittatus</i> )                                   | ?                     |                        | Malaysia lowland and foothill forest      |
| Reddish Scops Owl ( <i>O. rufescens</i> )  | ?                     |                        | Southeast Asia dense low-elevation forest |
| Giant Scops Owl ( <i>O. gurneyi</i> ) (sometimes <i>Mimizuku gurneyi</i> )         | ?                     |                        | Philippines lowland rain forest           |
| Tawny-Bellied Screech Owl ( <i>O. watsonii</i> )                                   | ?                     |                        | Amazonia rain forest                      |
| Puerto Rican Screech Owl ( <i>O. nudipes</i> )                                     | ?                     |                        | Puerto Rico                               |
| Flores Scops Owl ( <i>O. alfredi</i> )   | ?                     |                        | Lesser Sundas mountain woods              |
| Rajah's Scops Owl ( <i>O. brookii</i> )  | ?                     |                        | Sumatra                                   |
| Lesser Sunda Scops Owl ( <i>O. silvicolus</i> )                                    | ?                     |                        | Lesser Sundas coastal forest              |
| Sandy Scops Owl ( <i>O. icterorhynchus</i> )                                       | ?                     |                        | African Gold Coast forest                 |
| Sokoke Scops Owl ( <i>O. ireneae</i> )   | ?                     |                        | East Kenya coastal forest                 |
| Mentaur Scops Owl ( <i>O. umbra</i> )  | ?                     |                        | Southwest Pacific coastal forest          |
| Cuban Screech Owl ( <i>O. lawrencii</i> )  | ?                     |                        | Cuba forest                               |
| Santa Barbara or Bearded Screech Owl ( <i>O. barbarus</i> )                        | ?                     |                        | Mexico                                    |
| Black-Capped Screech Owl ( <i>O. atricapillus</i> )                                | ?                     |                        | South America subtropical rain forest     |
| Rufescent Screech Owl ( <i>O. ingens</i> )   | ?                     |                        | South America subtropical forest          |
| Cinnamon Screech Owl ( <i>O. petersoni</i> )                                       | ?                     |                        | Peru and Ecuador high-cloud forest        |
| Cloud-Forest Screech Owl ( <i>O. marshalli</i> )                                   | ?                     |                        | Peru high-elevation cloud forest          |
| Colombian Screech Owl ( <i>O. colombianus</i> )                                    | ?                     |                        | Colombia high-elevation mountain forest   |
| Bare-Shanked Screech Owl ( <i>O. clarkii</i> )                                     | ?                     |                        | Central America highland forest           |
| White-Throated Screech Owl ( <i>O. albogularis</i> )                               |                       | ?                      | Northern Andes highland cloud forest      |
| Roborate Screech Owl ( <i>O. roboratus</i> )                                       |                       | ?                      | Peru Andes highland forest                |
| Seychelles Scops Owl ( <i>O. insularis</i> )                                       | ?                     |                        | Mahe in Seychelles                        |
| São Thomé Scops Owl ( <i>O. hartlaubi</i> )  | ?                     |                        | São Thomé island                          |
| Lan Yu Scops Owl ( <i>O. elegans botelensis</i> )                                  | ?                     |                        | Taiwan forests                            |
| Pacific Screech Owl ( <i>O. cooperi</i> )  | ?                     |                        | Neotropics deciduous and evergreen forest |
| Anjouan Island Scops Owl ( <i>O. rutilus capnodes</i> ) (recently extinct)         | (?)                   |                        | Anjouan Island forests?                   |
| Mauritius Scops Owl ( <i>O. commersoni</i> ) (recently extinct)                    | (?)                   |                        | Mauritius Island forests?                 |
| <i>Bubo</i> , Eagle-Owls:  |                       |                        |   |
| Forest Eagle-Owl ( <i>B. nipalensis</i> )  | x                     |                        | India Himalayas dense submontane forest   |
| Shelley's Eagle-Owl ( <i>B. shelleyi</i> )   | ?                     |                        | Africa tropical and subtropical forest    |
| Akun Eagle-Owl ( <i>B. leucostictus</i> )  | ?                     |                        | Africa tropical and subtropical forest    |
| Fraser's Eagle-Owl ( <i>B. poensis</i> )   | ?                     |                        | Africa tropical and subtropical forest    |
| Barred or Malay Eagle-Owl ( <i>B. sumatranus</i> )                                 | ?                     |                        | Greater Sundas forests                    |
| Milky or Verreaux's Eagle-Owl ( <i>B. lacteus</i> )                                | ?                     |                        | Sub-Sahara Africa dense riverine forest   |
| Philippine Eagle-Owl ( <i>B. philippensis</i> )                                    | ?                     |                        | Philippine Islands tropical rain forest   |
| Nduk Eagle-Owl ( <i>B. vosseleri</i> )   | ?                     |                        | Tanzania Usambara Mountain forests        |
| Leguat's Owl ( <i>B. leguati</i> ) (recently extinct)                              | (?)                   |                        | Leguat forests                            |



**Table 1-Owls primarily associated with old tropical or temperate forests<sup>a</sup> (continued)**

| Species  | Tropical <sup>b</sup> | Temperate <sup>b</sup> | Range, habitat                                |
|--|-----------------------|------------------------|---|
| <i>Strix</i> , Wood Owls:  |                       |                        |   |
| Northern Spotted Owl ( <i>S. occidentalis caurina</i> )                            |                       | x                      | Western North America old-growth conifers     |
| California Spotted Owl ( <i>S. occidentalis occidentalis</i> )                     |                       | x                      | California mixed- and old-growth conifers     |
| Himalayan Wood Owl ( <i>S. aluco nivicola</i> )                                    |                       | x                      | Eastern Himalayas oak and conifer forest      |
| Scully's Wood Owl ( <i>S. aluco biddulphi</i> )                                    |                       | ?                      | Kashmir                                       |
| Brown Wood Owl ( <i>S. leptogrammica</i> )   | x                     |                        | Indo-Malaysia hill and submontane jungles     |
| Fulvous Owl ( <i>S. fulvescens</i> )   | ?                     |                        | Neotropics cloud and mountain forest          |
| Malay Wood Owl ( <i>S. orientalis</i> )  | ?                     |                        | Malaysia forests                              |
| Spotted Wood Owl ( <i>S. seloputo</i> )  | ?                     |                        | Malaysia forests                              |
| Rufous-Legged Owl ( <i>S. rufipes</i> )  | ?                     |                        | South America dense tropical forest           |
| Rusty-Backed Owl ( <i>S. hylophila</i> )   | ?                     |                        | South America dense tropical forest           |
| Mauritius Owl ( <i>S. sauzieri</i> ) (recently extinct)                            | (?)                   |                        | Mauritius forests?                            |
| <i>Ciccaba</i> , Mottled Owls:   |                       |                        |   |
| Black-and-White Owl ( <i>C. nigrolineata</i> )                                     | x                     |                        | Neotropics lowland evergreen forest           |
| Black-Banded Owl ( <i>C. huhula</i> )  | ?                     |                        | Amazon Basin lowland tropical forest          |
| Rufous-Banded Owl ( <i>C. albitarsis</i> )   |                       | ?                      | Andes humid temperate forest                  |
| African Wood Owl ( <i>C. woodfordii sokokensis</i> )                               | ?                     |                        | Sub-Sahara Africa lowland and mountain forest |
| Crested Owls and relatives ( <i>Lophotrix</i> spp.):                               |                       |                        |   |
| Crested Owl ( <i>L. cristata</i> )   | x                     |                        | Neotropical dense forest                      |
| Maned Owl or Akun Scops Owl ( <i>L. lettii</i> ) (sometimes <i>Jubula lettii</i> ) | ?                     |                        | West Africa tropical forest                   |
| Fish Owls ( <i>Ketupa</i> spp.):   |                       |                        |   |
| Blakiston's Fish Owl ( <i>K. blakistoni</i> )                                      |                       | x                      | Southeast Asia riverine forest                |
| Tawny Fish Owl ( <i>K. flavipes</i> )  |                       | ?                      | Southeast Asia riverine forest                |
| Fishing Owls ( <i>Scotopelia</i> spp.):  |                       |                        |   |
| Pel's Fishing Owl ( <i>S. peli</i> )   | ?                     |                        | Africa gallery and tropical rain forest       |
| Rufous Fishing Owl ( <i>S. ussheri</i> )   | ?                     |                        | Africa gallery and tropical rain forest       |
| Vermiculated Fishing Owl ( <i>S. bouvieri</i> )                                    | ?                     |                        | Africa gallery and tropical rain forest       |
| Spectacled Owl and relatives ( <i>Pulsatrix</i> spp.):                             |                       |                        |   |
| Spectacled Owl ( <i>P. perspicillata</i> )   | ?                     |                        | Neotropical lowland forest                    |
| White-Chinned or Tawny-Browed Owl ( <i>P. koeniswaldiana</i> )                     | ?                     |                        | Neotropical lowland forest                    |
| Rusty-Barred or Band-Bellied Owl ( <i>P. melanota</i> )                            | ?                     |                        | Neotropical lowland forest                    |
| Pygmy-Owls ( <i>Glaucidium</i> spp.):  |                       |                        |   |
| Red-Chested Owlet ( <i>G. tephronotum</i> )  | ?                     |                        | West Africa rain forest                       |
| Chestnut-Backed Owlet ( <i>G. sjostedti</i> )                                      | ?                     |                        | West central Africa lowland rain forest       |
| Andean Pygmy-Owl ( <i>G. jardinii</i> )  |                       | ?                      | Andes wet dense montane forest                |
| Albertine Owlet ( <i>G. albertinum</i> )   | ?                     |                        | Zaire   |
| Cuckoo Owl ( <i>G. cuculoides</i> )  |                       | ?                      | Himalayan forests                             |
| Eared Owls ( <i>Asio</i> spp.):  |                       |                        |   |
| Abyssinian Long-Eared Owl ( <i>A. abyssinicus</i> )                                | ?                     |                        | East Africa                                   |
| Madagascar Long-Eared Owl ( <i>A. madagascariensis</i> )                           | ?                     |                        | Eastern Madagascar humid forests              |
| Long-Whiskered Owlet ( <i>Xenoglaux loweryi</i> )                                  | x                     |                        | Peru Andes upper subtropical cloud forest     |
| Papuan Hawk Owl ( <i>Uroglaux dimorpha</i> )                                       | x                     |                        | New Guinea                                    |

**Table 1-Owls primarily associated with old tropical or temperate forests<sup>a</sup> (continued)**

| Species  | Tropical <sup>b</sup> | Temperate <sup>b</sup> | Range, habitat                        |
|--|-----------------------|------------------------|---------------------------------------|
| Hawk Owls ( <i>Ninox</i> spp.):  |                       |                        |                                       |
| Rufous Owl ( <i>N. rufa</i> )  | ?                     |                        | Australia                             |
| Ochre-Bellied Hawk Owl ( <i>N. perversa</i> )  | ?                     |                        | Celebes deep virgin forests           |
| Andaman Hawk Owl ( <i>N. affinis</i> )   | ?                     |                        | East Indies forests                   |
| Philippine Hawk Owl ( <i>N. philippensis</i> )   | ?                     |                        | Philippines forests                   |
| Indonesian Hawk Owl ( <i>N. squamipila</i> )   | ?                     |                        | Southeast Asian island forests        |
| Brown Owl ( <i>N. theomacha</i> )  | ?                     |                        | New Guinea lowland rain forest        |
| Fearful Owl ( <i>Nesasio solomonensis</i> )  | ?                     |                        | Solomon Island lowland primary forest |
| Tengmalm's or Boreal Owl ( <i>Aegolius funereus</i> )                                  | x                     |                        | Holarctic conifer forest              |
| Forest Spotted Owlet ( <i>Athene blewitti</i> ) (recently extinct?)                    | (?)                   |                        | Central India deciduous forest        |
| Total living species, (x) known to be primarily associated with old forests (12 total) | 7                     | 5                      |                                       |
| (?) suspected to be primarily associated with old forests (71 total):                  | 63                    | 8                      |                                       |
| Total (83 spp. <sup>d</sup> )  | 70                    | 13 <sup>e</sup>        |                                       |

<sup>a</sup> Many additional owl species are not listed here that also occur in old forests but not necessarily as primarily selected habitat. See text for citations.

<sup>b</sup> x = primarily associated with old forests; ? = reportedly associated with old forests, but little is known of their ecology; (?) = recently extinct.

<sup>c</sup> Considered as a separate species, Javan Scops Owl (*Otus angelinae*), by Hume and Boyer (1991) and Amadon and Brown (1988).

<sup>d</sup> Includes listing of 2 subspecies of *Otus spilocephalus* under both tropical and temperate categories but only one listing of *Strix occidentalis* under temperate category.

<sup>e</sup> Includes listing of 2 subspecies of *Strix aluco* under both known and suspected categories.

In this report, I discuss the various old forests in which owls are found, the threats to the survival of forest habitats and owl populations, the need to conserve and restore owl populations and their old-forest habitats, and the roles owls have played in human cultures. All these topics need to be studied and considered in conservation plans if we are to provide successfully for continued existence of owls associated with old forests of the world.

## Owls of the Genus *Tyto*

Most species of *Tyto*, including the Barn Owl, inhabit grassy or open habitats. A few little-known species, however, occupy deeply forested environments.

**Celebes Barn Owl**-This species inhabits rain forests of Celebes (Everett 1977). Hume and Boyer (1991) noted that it occurs in rain forests of several of the Sulawesi (Celebes) islands but that it also is associated with lowland habitats now eroded by deforestation. Little is known of its ecology.

**Sooty Owl and Lesser Sooty Owl**-Another little-studied *Tyto*, the Sooty Owl occupies dense forests of eastern Australia and New Guinea (Clark and others 1978, Everett 1977, Pizzey 1980, Prestt and Wagstaffe 1973; also see fig: 59). Like the Celebes Barn Owl, its ecology is also little known. Cayley (1975) noted that the Sooty Owl occurs as isolated pairs in heavy mountain forests. Pizzey (1980:205) denoted habitat of the Sooty Owl as "dense tropical, subtropical and temperate rain-forests and fern-gullies."

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