Nest-Site Selection by Black Sparrowhawks *Accipiter melanoleucus*: Implications for Managing Exotic Pulpwood and Sawlog Forests in South Africa

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ABSTRACT / This study provides timber growers with silvicultural guidelines for establishing and maintaining nest-tree habitat for native black sparrowhawks (*Accipiter melanoleucus*) in commercial planted forests in South Africa. In this country, exotic eucalypts and pines are planted principally for pulpwood and sawlog production. Nineteen nests were sampled in indigenous forests and 58 nests in exotic forests. Although mean nest heights differed between indigenous and exotic trees, in all trees, nests were positioned, on average, at 64% of tree height. Black sparrowhawks nested near stand edges, probably seeking a compromise between nesting adjacent to open hunting habitat and selecting an insulated tree from within the forest. Black sparrowhawks nested in tall trees (\(X = 18–33\) m for different tree species classes) with a large diameter (>60 cm). Unfortunately, the South African pulpwood and sawlog industry employ short rotations (<16 years) and high tree densities (>700 trees/ha) that do not allow the trees to attain the characteristics suitable for black sparrowhawk nesting sites. Eucalypt and pine nest stands must be of 25 × 25 m minimum size and incorporate 10 trees at minimum heights of 21 and 18 m and diameters of 37 and 35 cm, respectively. If such nest-tree stands are set aside as islands in a sea of commercial forests, and black sparrowhawks and other forest raptors nest in them, timber growers will improve the tree-nesting raptor diversity of planted forests. If, however, these raptors prey upon species of conservation importance, the management recommendations could be reversed to limit the potential for predation.

The management of forest raptor nesting habitat has recently drawn considerable attention as deforestation depletes mature forest stocks and commercial afforestation alters the tree-stand structure and species composition of potential nesting habitats (Block and others 1994, Forsman and others 1996). Whereas in indigenous forests set aside for conservation, natural succession guarantees a continuous supply of large trees, in planted forests afforestation provides same-age trees that change in structure over time. Nest stands in planted forests must therefore be actively managed to provide tree-nesting forest raptors with suitable nesting habitat on a sustainable basis (Lilieholm and others 1993, Selas 1996).

In South Africa, only eucalypt (*Eucalyptus* spp.), pine (*Pinus* spp.), wattle (*Acacia* spp.) and poplar (*Populus* spp.), species exotic to Africa, are planted commercially. These trees primarily produce pulpwood used for paper and particleboard production and sawlogs used for veneer and plywood (Anon. 1998). Exotic commercial trees were first planted in South Africa in 1876, and by 1997 the area under commercial plantations (15,181 km\(^2\)) was almost four times larger than existing indigenous forests (Low and Rebelo 1996, Van der Zel 1996, Anon. 1998). Although this large-scale afforestation and the resulting monoculture of closed-canopy, even-aged exotic trees has negatively impacted avian diversity (Allan and others 1997), some birds, such as the tree-nesting raptors, have benefited from the arrival of exotic trees (Steyn 1977). It is not surprising that 25 of the 32 tree-nesting raptors of southern African (*Family Accipitridae* excluding vultures), including nine eagles and seven accipiters, have been recorded nesting in exotic trees (Steyn 1982, G.M. personal observation).

One of the species that benefited from afforestation is the black sparrowhawk (*Accipiter melanoleucus*), a shy and skulking tree-nesting raptor that occurs in forested areas of Africa south of the Sahara. The black sparrowhawk inhabits forest fringing streams, dry decidu-
ous forests, and even isolated stands of indigenous or exotic trees, but is absent from very large, unbroken forests (Brown and Amadon 1989). The black sparrowhawk has been particularly successful in exploiting planted exotic forests for nesting. In one region of South Africa, the rapid expansion of planted forests over 80 years has enabled this species to extend its range and increase in numbers from approximately 60 to 840 pairs (Allan and Tarboton 1985). Most nests (99 of 103) found in this region were in mature, exotic eucalypt, poplar, or pine trees (Tarboton and others 1978, Allan and Tarboton 1985). The habitat selection of the black sparrowhawk, coupled to its size (males 450–650 g; females 750–980 g) and prey preference (birds, predominantly columbids), makes it an Afro-tropical counterpart of the Northern goshawk (*Accipiter gentilis*) found in the Nearctic and Palearctic (Brosset 1973, Biggs and others 1979, Brown and Amadon 1989, Malan and Robinson 1999).

When managing tree stands as nesting habitat, various ecological and behavioral factors that influence each species’ nest-site selection should be taken into account. These include the microhabitat at the nest (e.g., the positioning and placement of the nest within the tree), the tree species selected and stand density near nest-site trees (Speiser and Bosakowski 1987, 1988, Cerasoli and Penteriana 1996, Selas 1996). Also of importance are macrohabitat or landscape features that include the positioning of the nest within the forest and its proximity to topographical features such as roads and waterways (Andrew and Mosher 1982, Allan and Tarboton 1985).

The objective of this study is to provide commercial timber growers with silvicultural guidelines for creating and managing exotic nest-tree stands for black sparrowhawks in forests managed for pulpwood and sawlog production. A further objective is to alert South African commercial timber growers to the fact that small, nest-tree stands within planted forests can be actively managed to improve tree-nesting raptor diversity. We first compare characteristics of nests trees with those of surrounding trees in indigenous, eucalypt, pine, and poplar forests, and then compare these characteristics with those normally found in exotic stands managed for commercial pulpwood and sawlog trees. Second, we examine nest-site characteristics such as nest-to-edge distances and stand size and compare topographical features with randomly selected sites.

**Methods**

**Study Area**

Black sparrowhawk nest sites were located for study via forest surveys in the Western Cape, Eastern Cape, KwaZulu-Natal, Gauteng, Free State, Mpumalanga, Northern, and North-West provinces of South Africa to investigate the nesting habitat selection over a wide range of geographic areas and forests (Figure 1). Tree stands were surveyed in vegetation types ranging from forests and thickets, open plain savannas and grasslands, to succulent shrublands and fynbos (maccia heathland) (Low and Rebelo 1996). The mean annual rainfall of these vegetation types ranged from 200 to over 1000 mm.

**Nest-Site and Nesting Habitat Characteristics**

The authors and members of falconry and bird clubs located 77 black sparrowhawk nests. Although only 12 of these were found by means of a systematic search (cf. Daw and others 1998), we analyzed the nest-site data as one sample because of the black sparrowhawk’s wide selection of forest and nest-tree types. The search method biased the sample towards nests in accessible small forests, but the silvicultural cost of commercial forestry necessitated a determination of the minimum-planting forest size for breeding black sparrowhawks. Only nest trees located in monocultures were studied, and tree species were grouped into indigenous, eucalypt, pine, and poplar species classes. A minimum sample size of 10 nest trees for each species class was obtained. The following nest-tree characteristics were recorded: the tree diameter at breast height (1.4 m; DBH) of all stems ≥22 cm in diameter; tree height (T), nest height (N), height of the first foliage (L), and the height of the first side branch (R; irrespective of if it was dead or alive). The leaf-to-canopy zone was calculated as the distance from the lowest foliage to the top of the tree (T–L) and the branch-to-canopy zone as from the lowest side branch to top of the tree (T–R; Figure 2). The percent nest height (H) was the proportional distance the nest was placed from the top of the tree ([$(T–N)/T$]100) and percent nest branch-to-canopy height was the proportional distance the nest was placed from the top of the branch-to-canopy zone ([$(N–R)/(T–R)$]100). Nests were recorded as being placed within the canopy (i.e., at or above the height of the first foliage) or below the canopy (lower than first foliage). Each nest was scored as either being positioned in a main fork, against the main branch, or on a side branch. The number of branches supporting the nest was also counted.

The characteristics of trees in proximity to the nest tree (i.e., surrounding trees) were sampled from 42 self-sown (eucalypt, poplar, and indigenous) and 17 planted stands (eucalypt and pine). The characteristics of the surrounding trees were sampled within four $30 \times 4$-m transects, starting at the base of the nest tree and...