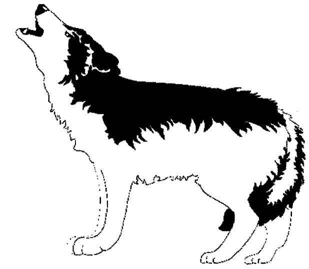
In My Opinion



Residual trees: wildlife associations and recommendations

John E. Hunter and Monica L. Bond

Abstract Managers and researchers have devoted considerable attention to old-growth forests and specific components of these forests such as snags and large woody debris. Large green residual or remnant trees have been less emphasized. Within the intensively managed coastal redwood (*Sequoia sempervirens*) forests of northwestern California, these residual trees are often the only remaining complex structural elements in a matrix of younger forest. As such, they provide important habitat for wildlife normally associated with older forests such as red tree vole (*Arborimus pomo*), fisher (*Martes pennanti*), bald eagle (*Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), marbled murrelet (Brachyramphus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), Vaux's swift (*Chaetura vauxi*), and wandering salamander (*Aneides vagrans*). Despite the obvious value of these trees to wildlife, and the fact that they are essentially a nonrenewable resource, no regulatory protection exists for these monetarily valuable trees. Accordingly, we recommend increased retention and management of these resources, as well as increased research on their role in managed forest ecosystems.

Key words forestry, redwood, residual trees, *Sequoia sempervirens*

Considerable attention has been devoted to conserving "old-growth" forests and related wildlife resources (Ruggiero et al. 1991, Spies and Franklin 1996). Some components of these older forests, particularly standing dead trees (snags) and large woody debris, also are important to maintain biological, structural, and functional diversity when they occur in younger, managed forests (Maser et al. 1979, Harmon et al. 1986, Bull et al. 1997). However, in many intensively managed forests these components have been harvested selectively or removed systematically for pest management, fire control, and safety purposes. The resulting vigorously growing, "clean" forests often have limited value for wildlife typically associated with older forests. Other older forest components, such as large residual or remnant live trees, also have significant value to wildlife, but have been much less considered by managers and researchers. In this paper, we discuss the value of large green residual trees, individually and in small stands, and suggest the need for an increased emphasis to retain them in managed, younger forests. We use the managed coastal redwood (*Sequoia sempervirens*) forests of northwestern California as our primary example, but the information presented here also generally applies to forests in other regions. Given the paucity of published information on residual trees in the redwood forests of California, we rely greatly on unpublished information.

A century of harvest

Most redwood forests in California have been owned privately and logged repeatedly over the past century; about 4% of the original redwood forest has not experienced at least some harvest activity (L. Fox, personal communication, 2000). Prior to World War II, the typical harvest method was widespread clear-cutting using steam donkeys and railroads, mostly in easily accessible forests close to the coast (O'Dell 1996). After the war, advances in technology allowed industry to move into new areas and selectively choose the best trees for harvest. Based on the utilization standards of the time, many large green trees that were deformed or diseased had little or no market value and were deemed "cull" and left standing. In addition, some large trees were not harvested for other reasons, such as maintaining seed trees for regeneration and for tax assessment purposes (O'Dell 1996). Characteristics of these trees today often include fungal infections and decadence, large cracks, deeply furrowed bark, broken tops and multiple leaders, cavities and basal hollows, large-diameter boles and limbs, defect in form ("sweep" or "crook"), the presence of epiphytes, and an open-grown or "wolfy" appearance. Many of these attributes are associated with high levels of wildlife use (Bull et al. 1997). These individual large residual trees or small stands of residual trees are often the only remaining complex structural elements in a matrix of younger forest. As such, they provide the best foraging, resting, and breeding sites for wildlife normally associated with older forests. In addition, these large-diameter trees are often the only candidates for future recruitment of large snags and large woody debris.

Wildlife and residual trees

Numerous wildlife species, particularly some of those of special concern to biologists and managers, are known to directly benefit from the presence of residual trees in previously harvested areas. For example, red tree vole (*Arborimus pomo*) nests in redwood forests appear to be more abundant in residual Douglas-fir (*Pseudotsuga menziesii*) trees than in the surrounding younger trees; these residuals may serve as refugia for vole recolonization of harvested areas (L. Diller, personal communication, 2000). Forest bats are known to use redwood trees with basal hollows in remnant old-growth stands (Zielinski and Gellman 1999). Although fishers (*Martes pennanti*) are less common in the coastal redwood forests than in adjacent inland Douglas-fir-dominated forests, Klug (1997) noted that residual trees in redwood forests may be important to fishers as resting and denning sites.

Our knowledge of the value of residual trees to bird species is considerably greater than for other taxa. Bald eagles (*Haliaeetus leucocephalus*) nest successfully in individual and small stands of residual trees (L. Diller, personal communication, 2000). Two active peregrine falcon (*Falco peregrinus*) nests were discovered recently in residual redwood trees (L. Diller, personal communication, 1999), and a third was suspected when fledglings were observed in similar habitat (D. Fix, personal communication, 1999). Marbled murrelets (*Brachyramphus marmoratus*) were once thought to nest only in large, contiguous stands of old-growth forest. However, marbled murrelets in California occur in very small residual stands and in younger stands with residual trees in coastal Humboldt (T. Bartlett and S. McAllister, personal communication, 2000), Mendocino (W. Stevens and E. Burkett, personal communication, 2000), and San Mateo (J. Bulger and D. Suddjian, personal communication, 2000) counties. The reproductive success of marbled murrelets in these situations was not known. Presence of northern spotted owls (*Strix occidentalis caurina*) in second-growth redwood forests appears correlated with presence of residual trees (Folliard 1993, Thome et al. 1999). One study found 62% of spotted owl pairs associated with younger redwood forests nested in stands with residual trees present, and in some cases, a residual nest tree was the only large tree in a stand of very young second-growth (Folliard 1993). More importantly, Thome et al. (1999) reported that number of residual trees/acre was a significant positive predictor of high northern spotted owl reproductive success. Both of these studies defined residual trees as those significantly older than the surrounding stand. Vaux's swift (*Chaetura vauxi*) breeding distribution in California corresponded to the historical distribution of redwood (Sterling and Paton 1996), probably because swifts used large hollow trees for nesting and roosting (Bull and Collins 1993). Sterling and Paton (1996) suggested that detections of Vaux's swift in second-growth forests may have been explained by presence of residual trees. Many other bird species have undoubtedly benefitted from residual trees.

In younger forests, large residual trees are often the only recruitment source for very large woody debris to forest floor and stream environments. Large woody debris is a critical component for many forest-floor organisms, including amphibians and small mammals (Maser and Trappe 1984, Butts and McComb 2000). While much of the amphibian assemblage in redwood forests uses downed wood for cover, some species, such as the wandering salamander (*Aneides vagrans*), appear to be particularly associated with larger-diameter downed wood (H. Welsh, personal communication, 2000). Large woody debris in streams also greatly improves habitat quality for anadromous fish such as coho salmon (*Oncorhynchus kisutch*) and summer steelhead (*Oncorhynchus mykiss*, Naiman et al. 1992, Bisson et al. 1992).

In western coniferous forests outside of the redwood region, some of the organisms that benefit from presence of residual trees include lichens (Peck and McCune 1997), old-growth canopy arthropods (Schowalter 1995), ospreys (*Pandion haliaetus*, Niemi and Hanowski 1997), marbled murrelets (Grenier and Nelson 1995; L. Folliard, personal communication, 2000), California spotted owls (*S. o. occidentalis*, Moen and Gutiérrez 1997), northern spotted owls (North et al. 1999, Irwin and Rock 2000), some neotropical migrant birds (Hansen et al. 1995, Schieck et al. 2000), big brown (*Eptesicus fuscus*) and silver-haired (*Lasionycteris noctivagans*) bats (Vonhof 1996), and northern flying squirrels (*Glaucomys sabrinus*, Carey 2000).

Recommendations for research and management

During the past 3 decades, the timber industry in northwestern California has generally transitioned from selection logging to even-age management of redwood forests, using clear-cutting followed by intensive fuels management, artificial regeneration, and treatments to control hardwoods and brush (O'Dell 1996). Even-age management practices often encourage the removal of large residual trees to maximize growing space and stand productivity. This emphasis on even-age management, combined with the rising value of old-growth redwood lumber, has increased pressure to harvest residual trees. Despite the importance of these increasingly rare trees to wildlife, and that only a small proportion of any given tree may actually be merchantable, no large residual tree retention requirement exists for timber harvest plans on state and private lands in California. This is in contrast to California Forest Practice Rules, which provide guidelines for snag retention and mitigation for harvest of late succession forest on these same lands.

While the wildlife value of residual trees in managed forests is apparent, research on their role in managed forest ecosystems should be conducted. Improved definitions of what constitutes a residual tree or stand are needed, as are improvements in forest inventory methodologies so that the point locations of these resources can be identified, recorded, and monitored. Spatial distribution and retention levels appropriate for particular landscapes need to be estimated, as do methods to evaluate the relative value of individual trees to wildlife. The necessary characteristics of any buffer zones around residuals also need to be estimated to maximize their persistence (e.g., protection from wind) and value to wildlife.

Most importantly, we urge forest managers to quickly institute voluntary retention and replacement standards for what has become, for practical purposes, a nonrenewable resource. "Salvage" logging of residual trees should be avoided if conserving wildlife associated with older forests is a concern. Residual trees should be retained as part of any variable retention harvest prescription (Franklin et al. 1997). On a landscape scale, residual trees or stands should be considered as potential focal points for forest restoration or species recovery efforts.

It is encouraging to note that some large timberland managers have recently adopted voluntary measures to conserve this limited resource. Mendocino Redwood Company provides its foresters with a guideline that no redwood tree at least 200 years old and greater than 122 cm diameter at breast height and no Douglas-fir tree at least 200 years old and greater than 91 cm diameter at breast height should be harvested. In northwestern California, Simpson Timber Company generally retains 2 residual trees/0.4 ha of clearcut, whenever less than 15% of harvest areas are managed as watercourse and lake protection zones. Where older residual trees are not present, Simpson retains 2 smaller trees/0.4 ha for future recruitment of large green trees. We believe that without voluntary efforts by landowners to conserve this dwindling resource, some mandatory regulation of residual tree harvest ultimately will be implemented. Not only will maintaining residual trees help restore properly functioning forest systems, but protection of residuals will likely benefit timber managers in the long term by helping preclude the listing of additional species as "threatened" or "endangered" by regulatory agencies and by improving the likelihood that some listed species could be delisted eventually.

Acknowledgments. We thank William Condon, Lowell V. Diller, Ralph J. Gutiérrez, and William J. Zielinski for their input and reviews of earlier drafts.

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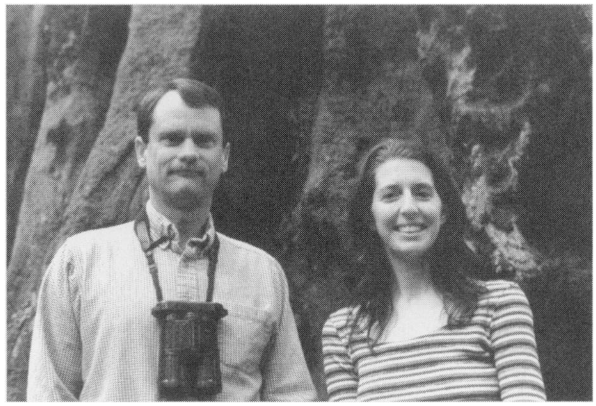

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