

Bald eagle nest site and nest tree characteristics in select biogeoclimatic zones of the 100 Mile House Forest District, British Columbia

Roger Packham¹

Abstract

Bald eagle (*Haliaeetus leucocephalus*) nest site and nest tree characteristics were studied in the Sub-Boreal Spruce (SBS), Interior Cedar–Hemlock (ICH), Sub-Boreal Pine–Spruce (SBPS), and Interior Douglas–fir (IDF) biogeoclimatic zones in the 100 Mile House Forest District, British Columbia. Dominant or codominant Douglas–fir (*Pseudotsuga menziesii*) containing large trunk forks or multiple forks of the trunk comprised 85% of 121 bald eagle nest trees. Black cottonwood (*Populus trichocarpa*) comprised 11% of known nest trees, and trembling aspen (*Populus tremuloides*), lodgepole pine (*Pinus contorta*), Ponderosa pine (*Pinus ponderosa*), and hybrid white spruce (*Picea glauca x engelmannii*) each contained 1% of known bald eagle nests. Tree height and diameter at breast height (DBH), nest height, and distance of nest to fish-bearing water were less for island nests compared to non-island nests. The mean distance of nests to fish-bearing water, by biogeoclimatic zone, was 78 m in the SBS, 104 m in the ICH, 241 m in the SBPS, and 368 m in the IDF. Ground slope and aspect were not factors in nest site location. The bald eagle nest trees studied were generally of low economic value to the forest industry as they contained less recoverable lumber than similar-sized trees with better form. To maintain bald eagle nesting habitat, large diameter, dominant or codominant trees containing large trunk forks, or multiple forks or leaders of the trunk and (or) large limbs should be identified and retained in groups, patches, or forest stands.

KEYWORDS: 100 Mile House Forest District, bald eagles, biogeoclimatic zones, nest sites, nest trees.

Contact Information

1 Senior Ecosystem Biologist, B.C. Ministry of Water, Land and Air Protection, Box 1600, 100 Mile House, BC V0K 2E0. Email: Roger.Packham@gov.bc.ca

Introduction

Bald eagle nest site selection and nest tree characteristics have been described for populations from Alaska (Hansen 1987; Hensel and Troyer 1964) to Florida (McEwan and Hirth 1979; Wood *et al.* 1989; Curnutt and Robertson 1994). Although approximately 69% of North America's bald eagles nest in British Columbia and Alaska (Gerrard 1983), only a few studies have investigated nesting habitat in the interior of British Columbia, mostly on large rivers and large lakes (Blood and Anweiler 1994; Poole 1997, 1998).

Maintaining suitable nesting and feeding habitats is one of the major challenges when managing for bald eagles (Anthony *et al.* 1982). In the 100 Mile House Forest District, approximately 4000 ha of forest is harvested on an annual basis (B.C. Ministry of Forests 2001). This represents one of the greatest potential causes of habitat loss and disturbance to bald eagles. Because the availability of suitable nest sites often regulates the breeding density of birds, species that depend on old-growth trees may be negatively affected by the loss of older seral stages, decreased rotation intervals, and intensive management practices (Newton 1979; Luman and Neitro 1980).

The study's primary objectives were to:

- describe nest tree and nest stand attributes of bald eagles, and
- provide recommendations for the retention of suitable nest trees in the 100 Mile House Forest District, British Columbia.

This study was confined to the Interior Douglas-fir (IDF), Interior Cedar-Hemlock (ICH), Sub-Boreal Pine-Spruce (SBPS), Sub-Boreal Spruce (SBS), and Montane Spruce (MS) biogeoclimatic zones of the 100 Mile House Forest District in the central interior of British Columbia (i.e., between 52°06' N and 51°03' N, and 120°30' W and 121°50' W; Figure 1). The study area ranges in elevation from 750 to 1400 m and is

Only a few studies have investigated nesting habitat in the interior of British Columbia, mostly on large rivers and large lakes.

Maintaining suitable nesting and feeding habitats is one of the major challenges when managing for bald eagles.

situated mainly in the Cariboo Plateau and Cariboo Basin ecosections, with a portion in the Quesnel Highland ecosection (Demarchi 1995). The climate is continental, ranging from warm, dry summers with a fairly long growing season and cool winters in the IDF (Hope *et al.* 1991), to moderately short, warm summers and cold winters in the MS (Hope *et al.* 1991).

Methods

Eagle nest tree and nest site characteristics were documented between March 4, 1998, and December 2, 1999. To understand the possible differences by biogeoclimatic zone, the objective was to examine more than 50% of the bald eagle nests located in each of the five zones. As many of the nests were in remote locations, accessibility often determined which nests were examined. Nest trees were accessed by foot, snowshoes, cross-country skis, boat, all-terrain vehicle, snowmobile, truck, or helicopter, or a combination thereof. Habitat characteristics recorded at each bald eagle nest tree included tree species, diameter (cm) at breast height (DBH), nest tree height (m), tree decay class, height (m) of nest rim above the ground, location of nest in tree, ground slope at base of nest (%), and aspect of ground slope. A Suunto PM-5 clinometer was used to determine nest tree height, height of nest rim above the ground, and ground slope at base of nest tree. A compass was used to determine aspect of ground slope. Information regarding nest tree species, tree decay class, and location of nest in tree was collected opportunistically (e.g., when operational forest planning flights were in proximity to nest trees that could not be examined from the ground).

Nest locations were overlaid on 1:30 000 forest cover inventory (FCI) base maps using MicroStation® mapping software. Biogeoclimatic zone, land ownership, and elevation were derived from FCI base maps for all known nest sites. Distance of nests from fish-bearing lakes, streams, and rivers was determined using Fish Information Summary System (FISS) and FCI maps. Fish-bearing waters included all water bodies known to support fish populations.

BALD EAGLE NEST SITE AND NEST TREE CHARACTERISTICS

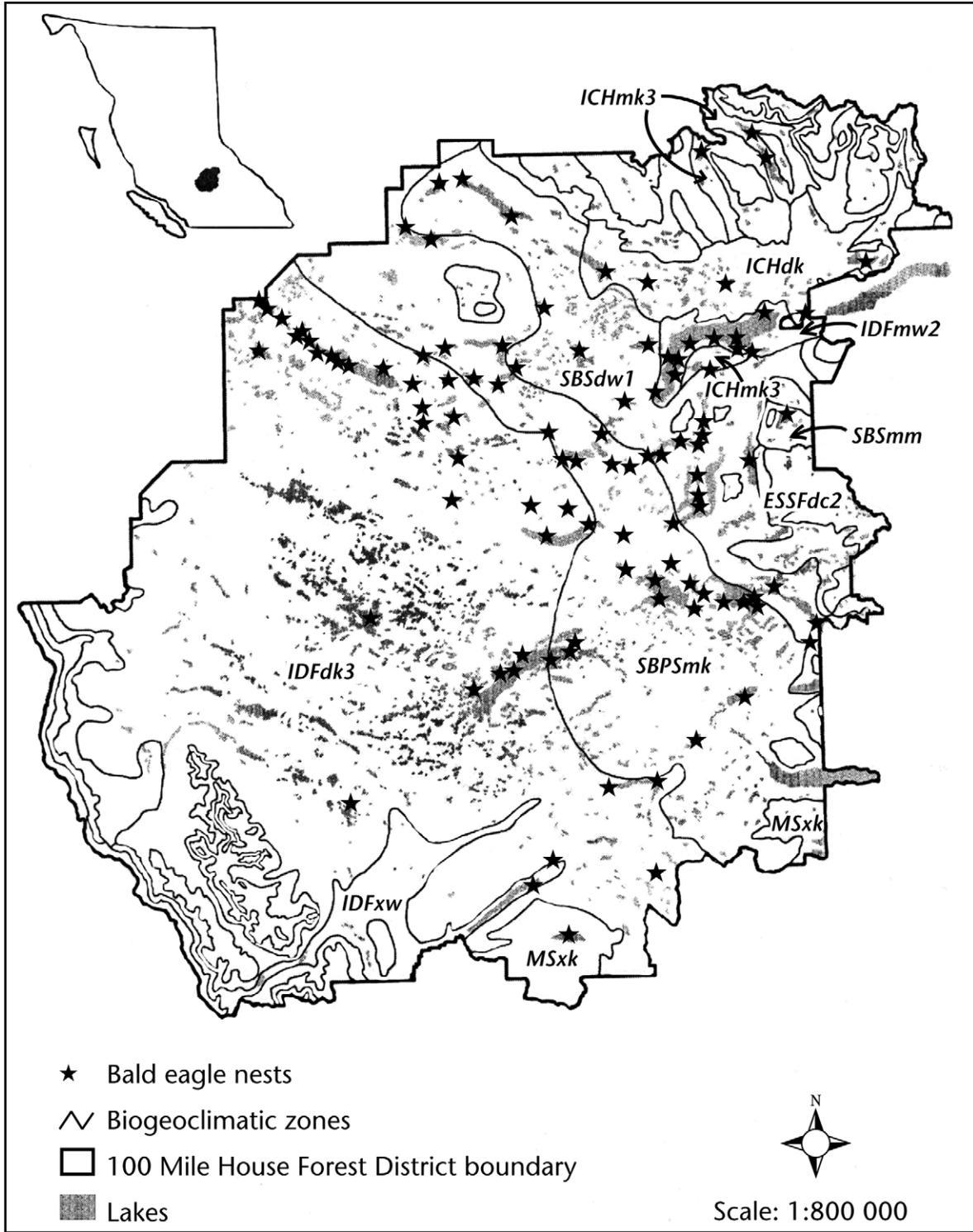


FIGURE 1. Bald eagle nest sites in the 100 Mile House Forest District.

Results

One hundred and twenty-one bald eagle nests were located in five biogeoclimatic zones (Table 1). Fifty-two nests were located in the IDF, 37 in the SBPS, 24 in the SBS, 7 in the ICH, and 1 nest in the MS biogeoclimatic zone. As only one nest location was known and studied in the MS, discussion of this zone will be limited. Nests on provincial Crown land, federal Crown land, and private land accounted for 78% ($n = 95$), 1% ($n = 1$), and 21% ($n = 25$), respectively, of all nest locations.

The distance of bald eagle nests to fish-bearing waters (all biogeoclimatic zones combined) ranged from 0 to 1680 m, with a mean distance of 253 m ($n = 121$). Analysis by biogeoclimatic zone, however, indicates the mean distance of bald eagle nests to fish-bearing waters was 78 m in the SBS, 104 m in the ICH, 241 m in the SBPS, and 368 m in the IDF. Eighteen (15%) bald eagle nests were located on lake islands, which were closer on average to fish-bearing waters than nests not located on islands. Also, the mean height and DBH of nest trees and nest height for island nests were less than other sites.

The DBH of 66 nest trees ranged from 46 to 146 cm and averaged 102 cm for all species combined. The height of 67 nest trees ranged from 19 to 44 m with an average height of 32 m. Nest height for 67 nest trees ranged from 15 to 42 m with an average of 27 m.

Of 73 bald eagle nests, 38% ($n = 28$) were situated in the crotch of a large branch and the trunk, 33% ($n = 24$) were located in a multiple fork (leader) of the trunk, 16% ($n = 12$) were located in the crotch of a fork in the trunk, 10% ($n = 7$) were located in the crotch of numerous branches (whorl) and the trunk, and 1% ($n = 1$) were located in the fork of a large branch.

Ground slope at the base of a nest tree was determined for 67 trees and ranged from level to 46% with an average slope of 15%. Aspect was measured for 67 nest trees, with 15 nests located on a north aspect, 5 northeast, 4 east, 5 southeast, 10 south, 10 southwest, 4 west, and 2 northwest. Twelve nest trees were located on flat ground.

Discussion

Bald eagles use a wide variety of tree species for nesting across their North American range, which suggests that these birds select for tree structure rather than species (Gerrard *et al.* 1975), and for prominence and security (Anthony and Isaacs 1989). Although this study did not determine the age of trees used for nesting, nest trees were mainly mature or old-growth, dominant or

codominant trees, similar to the findings of Stocck and Pearce (1981), Livingston *et al.* (1990), and Anthony *et al.* (1982). These trees provided a suitable nesting base mostly in crotches formed between large branches and the trunk, forks or multiple forks of the tree trunk, or in the crotch of numerous branches (whorl) and trunk. Dominant or codominant trees provide perches from which eagles search for prey (Sprunt *et al.* 1973; Hansen 1987) or predators, and also allow an unobstructed flight path to and from the nest (McEwan and Hirth 1979).

Most nest trees were forest veterans that had survived previous forest fire events or were reserved from previous forest harvesting. These trees were larger in diameter and height and were older than trees produced under current rotations of 80–120 years. Hodges *et al.* (1984) found that nests were present in greater than expected numbers when disturbed habitat contained some remnant old-growth trees. In this study, 20 (17%) bald eagle nests were located in large isolated veteran trees that were reserved from previous harvest.

Douglas-fir and black cottonwood comprised 85% and 11%, respectively, of known nest trees in the 100 Mile House Forest District. This differs from the findings of Campbell *et al.* (1990) and Poole (1997, 1998), who reported that deciduous trees comprised 63–83% of bald eagle nest trees on large lakes and rivers in the British Columbia interior. The study area was primarily a plateau landscape with differing types of available nest trees. Douglas-fir was the main tree species used for nesting in all biogeoclimatic zones, even in the SBPS and SBS where the relative availability of Douglas-fir trees is less than in the IDF and ICH biogeoclimatic zones.

The incidence of bald eagle use of dead trees for nesting in this study (10%) is similar to the 18% of dead nest trees reported by Blood and Anweiler (1994) for the province's interior. Most studies indicate that bald eagle nests are located predominantly in live trees. As no data were collected to determine whether nests were active, it is quite possible that some of the nest trees that are now dead may have been alive when bald eagles used them.

Fish availability determines where bald eagles nest (Livingston *et al.* 1990). The most important characteristics of bald eagle nest habitat, therefore, are proximity to water and open mature vegetation structure (Andrew and Mosher 1982). The IDF biogeoclimatic zone has greater than average distance of nests to fish-bearing waters and is the biogeoclimatic zone with the most disturbance related to forest harvesting and private land

BALD EAGLE NEST SITE AND NEST TREE CHARACTERISTICS

TABLE 1. Characteristics of bald eagle nest sites and nest trees in select biogeoclimatic zones in the 100 Mile House Forest District

Characteristic	All biogeoclimatic zones ^a				ICH				IDF				SBPS				SBS		MS	
	Average or %	CI ^b Range	No. nests	Average or %	CI ^b Range	No. nests	Average or %	CI ^b Range	No. nests	Average or %	CI ^b Range	No. nests	Average or %	CI ^b Range	No. nests	Average or %	CI ^b Range	No. nests	Average or %	
<i>Elevation (m)</i>	986	23.6 772–1370	121	988	74.2 820–1097	7	906.9	32.6 772–1150	52	1066.5	23.1 853–1158	37	1017	52.0 792–1182	24	1370	1			
<i>Distance to fish-bearing water (m)</i>	253.3	63.1 0–1680	121	103.9	60.3 22–240	7	368.4	115.0 0–1680	52	240.5	107.6 4–1410	37	77.6	39.4 4–390	24	3	1			
<i>Proximity to fish-bearing water</i>																				
Lake	81.8%		99	100%		7	75%		39	83.8%		31	87.5%		21	100%	1			
Stream/river	18.2%		22				25%		13	16.2%		6	12.5%		3					
<i>Tree DBH (cm)</i>	101.6	5.2 45.8–145.7	66	98.4	11.8 83.6–115.8	5	102.1	8.4 45.8–145.7	30	105.5	10.0 55.5–140.3	18	96.4	10.9 65–127.2	13	na				
<i>Tree height (m)</i>	31.7	1.4 18.5–43.8	67	34.3	5.5 27.1–43.8	5	31.4	2.1 20.1–42.5	30	31.2	2.6 20.4–41.1	18	32.8	3.7 18.5–40.7	13	22.3	1			
<i>Nest height (m)</i>	26.6	1.4 15.1–42.0	67	30.4	6.1 23.9–42.0	5	26.3	2.2 15.2–38.0	30	26.6	2.4 18.2–36.5	18	26.2	3.2 15.1–32.9	13	18.8	1			
<i>Tree species</i>																				
Douglas-fir	84.7%		83	57.1%		4	82.5%		33	92.6%		25	87.0%		20	100%	1			
Black cottonwood	11.2%		11	42.9%		3	10.0%		4	3.7%		1	13.0%		3					
Trembling aspen	1%		1				2.5%		1											
Lodgepole pine	1%		1				2.5%		1											
Hybrid white spruce	1%		1							3.7%										
Ponderosa pine	1%		1				2.5%		1											
<i>Tree decay class</i>																				
Class 1	60.7%		54	33.3%		2	61.8%		21	59.3%		16	70.0%		14	100%	1			
Class 2	28.1%		25	50.0%		3	26.5%		9	25.9%		7	30.0%		6					
Class 3	10.1%		9	16.7%		1	11.8%		4	14.8%		4								
Class 4	1.1%		1																	

^a ICH = Interior Cedar-Hemlock zone; IDF = Interior Douglas-fir zone; SBPS = Sub-Boreal Pine-Spruce zone; SBS = Sub-Boreal Spruce zone; MS = Montane Spruce zone.
^b 95% confidence interval.

development. Fraser *et al.* (1985) found that nests were closer to undeveloped shorelines than developed shorelines, hence the greater than average distance to fish-bearing water in the IDF.

Hansen (1987) suggested that the height-class of nest trees is important because eagle nests located above foraging areas and above the surrounding canopy enable bald eagles to simultaneously locate prey and nest. The results indicate, however, that nest trees located on islands were smaller in diameter, shorter in height, and supported nests that were lower in height above the ground than nests not located on islands. This suggests that tree height and diameter are not as important for island-nesting bald eagles because their close proximity to fish-bearing water provides better opportunities for concurrent monitoring of young and foraging (Hayword and Ohmart 1986). This finding agrees with Gerrard *et al.* (1975) who found that bald eagles preferred to nest on islands. Numerous nest trees in the study area showed evidence of having been climbed by black bears, with the possibility that bald eagle eggs or chicks were depredated, which may partially account for use of island nesting locations.

Gerrard *et al.* (1975) reported that nesting bald eagles in Manitoba and Saskatchewan preferred west and northwest aspects; however, in this study slope and aspect were not a factor in nest site location as bald eagles nested on slopes ranging from level to 46% and on all aspects. Anthony and Isaacs (1989) and Swenson *et al.* (1986) reported similar findings.

Management Implications

In this study, more than 95% of bald eagle nest trees examined in the 100 Mile House Forest District occurred in mature or old-growth, dominant or co-dominant, Douglas-fir and black cottonwood trees. These trees averaged more than 30 m in height and 90 cm DBH, and contained forks, multiple forks or leaders of the trunk, and (or) large limbs, and defects such as heart rot. Such trees are of low economic value to the forest industry as they contain less merchantable timber than trees of similar size with better commercial form. The retention of trees with these particular characteristics is recommended when they occur within 78 m of fish-bearing waters in the SBS, 104 m in the ICH, 241 m in the SBPS, and 368 m in the IDF.

To maintain bald eagle nesting habitat, the identification of suitable nest trees or stands before harvesting is recommended. Although bald eagles will use isolated

In this study, more than 95% of bald eagle nest trees examined in the 100 Mile House Forest District occurred in mature or old-growth, dominant or codominant, Douglas-fir and black cottonwood trees.

trees for nesting, bald eagle territories often contain more than one nest. Therefore, suitable nest trees should be retained in groups, patches, or forest stands. Groups or patches of nest trees are also more windfirm than isolated trees and provide for long-term replacement of nest trees that fall.

As over 20% of the known bald eagle nest trees were located on deeded land, I recommend notification of private landowners about bald eagle nesting requirements in proximity to fish-bearing waters. If landowners are developing a property, I recommend that they be encouraged to retain trees with the above characteristics.

Acknowledgements

Thanks are extended to Andrew, Mary, and Michael Packham for their assistance collecting field data. Special thanks to Doug Cooper for digitizing nest locations and the production of Figure 1. Thanks also to Don Blood, John Cooper, Neil Dawe, Rick Dawson, Cris Guppy, Andy Stewart, and Michaela Waterhouse, for editorial review of the draft manuscript. Helicopter support was provided by Weldwood of Canada Ltd. (now West Fraser Timber Co. Ltd.), Ainsworth Lumber Co., Lignum Ltd. (now Tolko Industries Ltd.), the Small Business Forest Enterprise Program (now BC Timber Sales), and Forest Renewal BC. The B.C. Ministry of Environment, Lands and Parks (now Water, Land and Air Protection) provided ground transportation.

References

- Andrew, J.M. and J.A. Mosher. 1982. Bald eagle nest site selection and nesting habitat in Maryland. *Journal of Wildlife Management* 46:382–390.
- Anthony, R.G. and F.B. Isaacs. 1989. Characteristics of bald eagle nest sites in Oregon. *Journal of Wildlife Management* 53:148–159.
- Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and

BALD EAGLE NEST SITE AND NEST TREE CHARACTERISTICS

- roosting bald eagles in the Pacific Northwest. Transactions of 47th North American Wildlife and Natural Resources Conference 47:332–342.
- Blood, D.A. and G.G. Anweiler. 1994. Status of the bald eagle in British Columbia. B.C. Environment, Lands and Parks, Victoria, B.C. Wildlife Working Report No. WR-62.
- British Columbia Ministry of Forests. 2001. Timber Supply Review: 100 Mile House Timber Supply Area Analysis Report. Victoria, B.C.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia. Volume 2: Nonpasserines, diurnal birds of prey through woodpeckers. Royal B.C. Museum and Environment Canada, Vancouver, B.C.
- Curnutt, J.L. and W.B. Robertson, Jr. 1994. Bald eagle nest site characteristics in south Florida. Journal of Wildlife Management 58(2):218–221.
- Demarchi, D.A. 1995. Ecoregions of British Columbia. Fourth Edition. B.C. Ministry of Environment, Lands and Parks, Victoria B.C. Map (1:2 000 000).
- Fraser, J.D., L.D. Frenzel, and J.E. Mathisen. 1985. The impact of human activities on breeding bald eagles in north-central Minnesota. Journal of Wildlife Management 49:585–592.
- Gerrard, J.M. 1983. A review of the current status of bald eagles in North America. In Biology and management of bald eagles and ospreys. D.M. Bird, N.R. Seymour, and J.M. Gerrard (editors). Harpell Press, Ste. Anne de Bellevue, Que. pp. 5–21.
- Gerrard, J.M., P. Gerrard, W.J. Maher, and D.W.A. Whitfield. 1975. Factors influencing nest site selection of bald eagles in northern Saskatchewan and Manitoba. Blue Jay 33:169–176.
- Hansen, A.J. 1987. Regulation of bald eagle reproductive rates in southeast Alaska. Ecology 68:1387–1392.
- Haywood, D.D. and R.D. Ohmart. 1986. Utilization of benthic-feeding fish by inland breeding bald eagles. Condor 88:35–42.
- Hensel, R.J. and W.A. Troyer. 1964. Nesting studies of the bald eagle in Alaska. Condor 66:282–286.
- Hodges, J.I., Jr., J.G. King, and R. Davies. 1984. Bald eagle breeding population survey of coastal British Columbia. Journal of Wildlife Management 48:993–998.
- Hope, G.D., W.R. Mitchell, D.A. Lloyd, W.L. Harper, and B.M. Wikeem. 1991. Montane Spruce zone. In Ecosystems of British Columbia. B.C. Ministry of Forests. Victoria, B.C. Special Report Series No. 6, pp. 183–194.
- Hope, G.D., W.R. Mitchell, D.A. Lloyd, W.R. Erickson, W.L. Harper, and B.M. Wikeem. 1991. Interior Douglas-fir zone. In Ecosystems of British Columbia. B.C. Ministry of Forests. Victoria, B.C. Special Report Series No. 6, pp. 153–166.
- Livingston, S.A., C.S. Todd, W.B. Krohn, and R.B. Owen, Jr. 1990. Habitat models for nesting bald eagles in Maine. Journal of Wildlife Management 54:644–653.
- Luman, I.D. and W.A. Neitro. 1980. Preservation of mature forest stages to provide wildlife habitat diversity. Transactions of 45th North American Wildlife and Natural Resources Conference 45:271–277.
- McEwan, L.C. and D.H. Hirth. 1979. Southern bald eagle productivity and nest site selection. Journal of Wildlife Management 43:585–594.
- Newton, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, S.D.
- Poole, K.G. 1997. Bald eagle and osprey inventory in the Fort St. James Forest District, 1996. Report submitted to Canadian Forest Products Ltd, Fort St. James, B.C. Unpublished.
- _____. 1998. Bald eagle and osprey inventory in the Vanderhoof Forest District, 1997. Report submitted to B.C. Ministry of Environment, Lands and Parks, Prince George, B.C. Unpublished.
- Sprunt, A., IV, W.B. Robertson, Jr., S. Postupalsky, R.J. Hensel, C.E. Knoder, and F.J. Ligas. 1973. Comparative productivity of six bald eagle populations. Transactions of 38th North American Wildlife and Natural Resources Conference 38:96–106.
- Stocek, R.F. and P.A. Pearce. 1981. Status and breeding success of New Brunswick bald eagles. Canadian Field-Naturalist 95(4):428–433.
- Swenson, J.E., K.L. Alt, and R.L. Eng. 1986. Ecology of bald eagles in the Greater Yellowstone Ecosystem. Wildlife Monographs No. 95.
- Wood, P.B., T.C. Edwards, Jr., and M.W. Collopy. 1989. Characteristics of bald eagle nesting habitat in Florida. Journal of Wildlife Management 53(2):441–449.

© FORREX—Forest Research Extension Partnership. ISSN 1488-4674. Information in this publication may be reproduced in electronic or print form for use in educational, training, and not-for-profit activities provided that the source of the work is fully acknowledged. However, reproduction of this work, in whole or in part, for commercial use, resale, or redistribution requires written permission from FORREX—Forest Research Extension Partnership. For this purpose, contact: Managing Editor, Suite 702, 235 1st Avenue, Kamloops, BC V2C 3J4.

Test Your Knowledge . . .

Bald eagle nest site and nest tree characteristics in select biogeoclimatic zones of the 100 Mile House Forest District, British Columbia

How well can you recall some of the main messages in the preceding extension note?

Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. The results of this study suggest that bald eagles use a wide variety of tree species for nesting because:
 - A) tree structure, prominence, and security are more important than tree species
 - B) ground slope is more important than tree species
 - C) slope aspect is more important than tree species
2. The literature suggests that the most important characteristic of bald eagle nest habitat is:
 - A) age of tree
 - B) proximity to water and open mature vegetation
 - C) tree height
 - D) shoreline development
3. Based on this study, to maintain bald eagle habitat, it is recommended that managers:
 - A) retain single trees with good commercial form within 78 m of fish-bearing water
 - B) maintain, in groups, patches or stands, large-diameter, dominant or co-dominant trees containing large trunk forks, or multiple forks or leaders, and (or) large limbs
 - C) retain single trees with multiple forks or leaders and (or) large limbs
 - D) retain large-diameter trees containing trunk forks on islands only

ANSWERS

1. A 2. B 3. B