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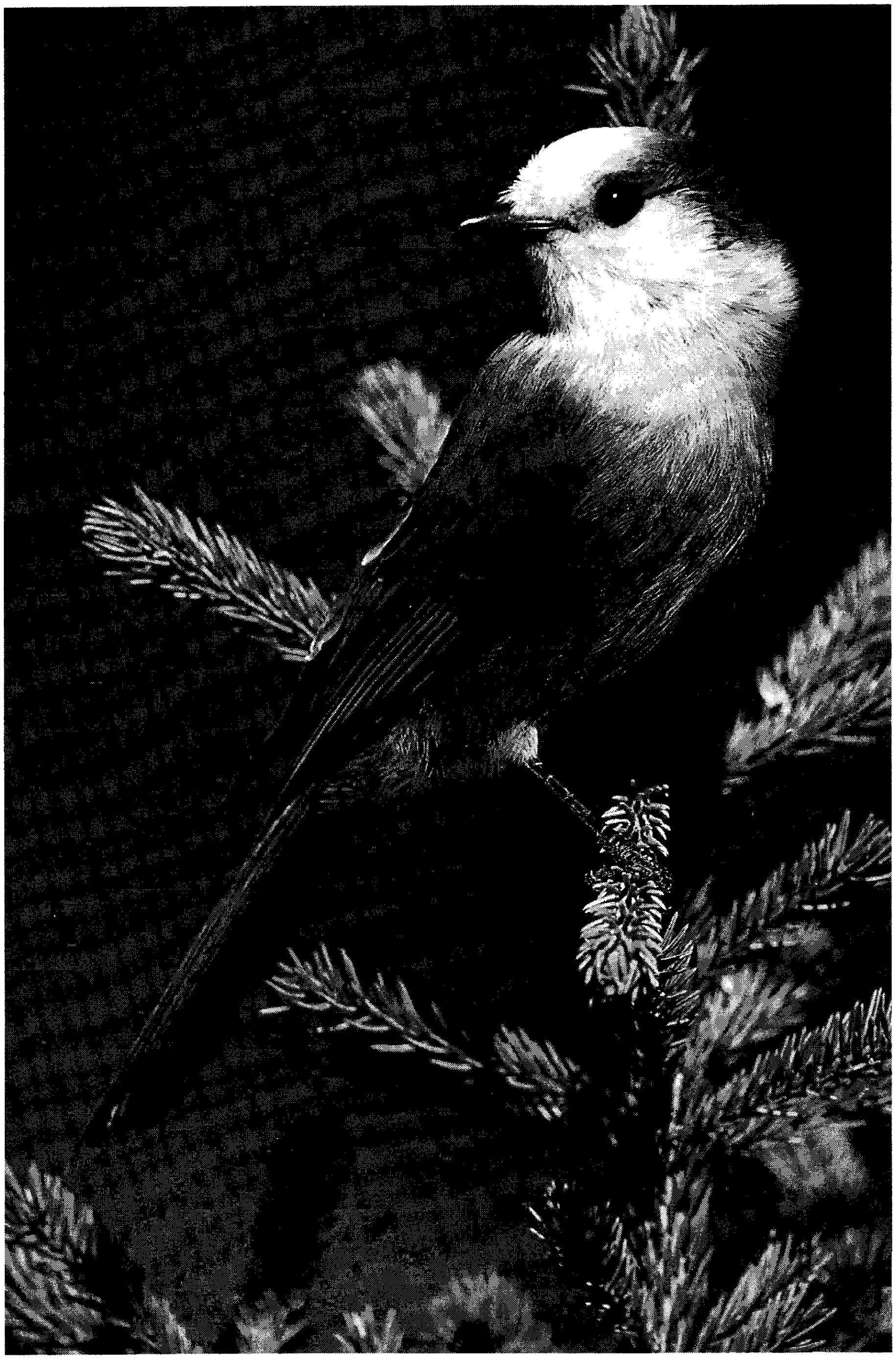
Habitat Capability Model for Birds Wintering in the Black Hills, South Dakota



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Abstract

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Habitat models have considerable economic effects on management decisions and are used to predict consequences of land management decisions on wildlife. The Black Hills National Forest uses the habitat capability model (HABCAP), but its accuracy relative to resident wintering bird populations is largely unknown. We tested the model's predictive accuracy for resident nongame birds wintering in 11 vegetation structural stages of ponderosa pine, quaking aspen/paper birch, and meadows in the Black Hills, South Dakota. Six species, hairy woodpecker, gray jay, black-capped chickadee, white-breasted nuthatch, red-breasted nuthatch, and dark-eyed junco, had HABCAP coefficients for vegetation structural stages during winter. Red crossbills were not previously included in the model, so we developed HABCAP coefficients for them. Predicted abundance of winter birds in vegetation structural stages based on HABCAP coefficients differed from observed abundance for gray jays, black-capped chickadees, white-breasted nuthatches, red-breasted nuthatches, and dark-eyed juncos. HABCAP coefficients were modified to reflect observed abundance patterns of birds. These changes to HABCAP coefficients should provide managers with more appropriate estimates of land management impacts on nongame birds wintering in the Black Hills.

Keywords: habitat models, winter birds, forest birds, logging in the Black Hills, South Dakota

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Habitat Capability Model for Birds Wintering in the Black Hills, South Dakota

Mark A. Rumble, Todd R. Mills, and Lester D. Flake

Contents

Introduction

Birds are sensitive indicators of vegetation conditions because they have relatively narrow habitat requirements (Martin and Finch 1995). Resident bird populations are relatively stable in winter (Ralph et al. 1993) and more closely associated with specific habitats than during summer (Huff et al. 1991, Manuwal and Huff 1987). Winter can be critical for birds in northern latitudes because food and cover have restricted distribution or abundance (Chambers and McComb 1997). If birds are year-residents, land managers must understand their winter habitat needs to insure that sufficient habitat exists to sustain populations (Morrison et al. 1985).

Managers of public land often use wildlife habitat models to predict the effects of their management on environmental resources. Habitat models for birds have been developed at several scales (e.g., Holt 1974, Thomas et al. 1975, Rotenberry and Wiens 1978). Models of bird habitat relationships in forest environments include vegetation life-form and vegetation succession because logging frequently affects the size and condition of forests (DeGraaf and Chadwick 1987). The Black Hills National Forest uses a vegetation-succession model (HABCAP) to predict the habitat capability of vegetation successional stages and the effects of logging on wildlife. The HABCAP model includes coefficients that quantify the relative quality (between 0 and 1.0) of habitat provided by forest vegetation for birds during the breeding season (e.g., Mills et al. 1996). Currently, the HABCAP model uses coefficients from the breeding season all year for resident birds. However, bird habitats use varies seasonally (Cody 1985, Hagar 1993). Thus, there is need to test the model coefficients to improve the reliability of the HABCAP model.

Habitat models are useful tools for land managers but should not be relied upon until tested (Laymon and Barrett 1984). Land management decisions with long-term affects on local or regional economies and wildlife habitat are partly based on outputs from models such as HABCAP. The HABCAP model for birds during the breeding season has been tested for some birds in the Black Hills (Mills et al. 1996). However, the HABCAP model for birds wintering in the Black Hills remains untested.

Objectives

The objectives of this study were to test the habitat associations of birds predicted by the HABCAP model in the Black Hills, and either revise or develop new HABCAP model coefficients for wintering birds. "Existing" references the HABCAP model coefficients presently, "new" applies to model coefficients developed and "final" pertains to existing or new model coefficients after testing and necessary revisions.

Methods

Study Area

This study was conducted on the Nemo, Harney, and Pactola Ranger Districts of the Black Hills National Forest (BHNF), in the central Black Hills, South Dakota in the winters of 1992 and 1993 and 1993 and 1994. The Black Hills encompass approximately 15,540 km^2 on the west-central border of South Dakota and east-central border of Wyoming and is surrounded by prairie and shrub-steppe. Elevation ranges from 1450 to 1770 m. Annual precipitation for the area is approximately 46 cm (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climatological Data Annual Summary, South Dakota 1992–1993, Asheville, NC).

Vegetation

Climax vegetation in the central region of the Black Hills is mostly ponderosa pine/

snowberry (*Symphoricarpos albus*) or ponderosa pine/kinnikinnick (*Arctostaphylos uva-ursi*) (Hoffman and Alexander 1987). Quaking aspen (*Populus tremuloides*) occurs in monotypic stands and in drainages with paper birch (*Betula papyrifera*). Understory shrubs include: common juniper (*Juniperus communis*), serviceberry (*Amelanchier alnifolia*), ninebark (*Physocarpus monogynus*), chokecherry (*Prunus virginiana*), currant (*Ribes* spp.), Wood's rose (*Rosa woodsii*), russet buffaloberry (*Shepherdia canadensis*), wild spirea (*Spiraea lucida*), raspberry (*Rubus idaeus*), and poison ivy (*Toxicodendron rydbergii*).

Sampling Design

The BHNF is managed using land units (hereafter referred to as stands) approximately 4–32 ha in size. For applications using the HABCAP model, each stand is assigned a vegetation structural stage. Vegetation structural stages are assigned based on vegetation type and forested stands are further classified as shrub-seedling (<2.5 cm diameter-at-breast-height [DBH]), sapling-pole (2.5 to 22.9 cm DBH), mature (>22.9 cm DBH), or old-growth; sapling-pole and mature tree categories are further stratified into overstory canopy cover categories of 0 to 40%, 41 to 70%, and 71 to 100% (Buttery and Gillam 1983). Old-growth stands were >22.9 cm DBH and usually had multiple layers to the canopy with large diameter forest debris on the ground. After this study was initiated, the BHNF revised the criteria describing old-growth structural stages of ponderosa pine following Mehl (1996). Therefore, the old-growth vegetation structural stage identified in this study is referred to as mature multistoried stands.

Quaking aspen occurs as monotypic upland stands and also with paper birch in uplands and drainages. Although stands of quaking aspen and paper birch are vegetatively different from monotypic quaking aspen (Severson and Thilenius 1976), they are managed similarly by the BHNF. In this study, these stands are referred to as aspen/birch. We were unable to find adequate representation of the grass-forb and shrub-seedling structural stages of ponderosa pine and mature tree structural stages of aspen/birch. The vegetation structural stages included in this study are in table 1.

Table 1. Vegetation structural stages of ponderosa pine, quaking aspen/paper birch, and meadows included in a test of habitat capability model coefficients for birds during winter in the Black Hills, South Dakota.

Vegetation type	Diameter-at-breast-height category[1]	Overstory canopy cover
Ponderosa pine	Shrub-seedling	NA
Ponderosa pine	Sapling-pole	0–40%
Ponderosa pine	Sapling-pole	41–70%
Ponderosa pine	Sapling-pole	71–100%
Ponderosa pine	Mature	0–40%
Ponderosa pine	Mature	41–70%
Ponderosa pine	Mature	71–100%
Ponderosa pine	Mature multistoried	71–100%
Aspen/birch	Sapling-pole	0–40%
Aspen/birch	Sapling-pole	41–70%
Aspen/birch	Sapling-pole	71–100%
Wet meadow	NA	NA
Dry meadow	NA	NA

[1]*Vegetation structural stage categories from Buttery and Gillam (1983). Sapling-pole timber is <22.9 cm diameter-at-breast-height (DBH), mature timber is >22.9 cm DBH. Mature, multistoried category was formerly classified as old-growth.*

Stands representing the array of vegetation structural stages in ponderosa pine, aspen/birch, and meadows near the Charles E. Boldt Experimental Forest were identified from the Black Hills National Forest Resource Inventory System data base. We identified 7 prospective stands in each vegetation structural stage using 1:24,000 aerial photographs and U.S. Geological Survey quad maps. We visited each stand to verify the vegetation structural stage before final selection. Of the 21 aspen/birch sapling-pole stands, 9 (3 in each overstory category) were in monotypic aspen and 12 (4 in each overstory category) were in aspen/birch drainages. One mature multistoried stand of ponderosa pine was logged during the study, thus only 6 stands in the mature multistoried ponderosa pine structural stage were included.

Within each stand, we systematically selected 3 sites for bird counts. In ponderosa pine and monotypic aspen, sites were constrained to be 150–200 m apart and >150 m from an edge to avoid counting bird species in adjacent habitats and to avoid double counting individuals (Manuwal and Carey 1991, Robbins et al. 1989). In the aspen/birch drainages and in wet meadows and dry meadows, stands were not wide enough for sites to be >150 m from an edge, so sites were selected that were >150 m apart in the center of the stand.

Bird Counts

Three experienced observers counted birds between 15 December and 15 March each year (Robbins et al. 1989, Ralph et al. 1993) in a variable-radius circular plot (Reynolds et al. 1980) at each site for 2 days, twice each year (2 count-sessions/year). Bird counts were not conducted during snow storms or during periods when winds exceeded 10 km/hr. Each observer counted birds on different sites during each count-session and the daily order that sites were counted was reversed to decrease bias and to maximize the number of species detected (Verner and Milne 1989). Observers began counting birds at approximately 0800, and all counts were completed by 1500 (Manuwal and Carey 1991). Prior to bird counts, training was provided on visual and audio identification of birds and we practiced estimating distances (Verner and Milne 1989).

During bird counts, observers recorded all birds seen or heard for 8 minutes and recorded the estimated distance from the count station to each bird (Verner 1988). Counts began when the observer arrived at the count station (Ralph et al. 1993), but birds flushed œ100 m from the count-station while approaching it, were included. We also recorded whether birds observed were within the vegetation structural stage assigned to the count station, the sex of the bird, and activity of the bird.

Data Analysis

Coefficients in the HABCAP model quantify the relative quality (0 to 1.0) of vegetation structural stages as habitat able to sustain the optimum density of individuals for a particular area. For migrant birds, the model includes coefficients of feeding and cover for summer; for resident birds the model includes year-long coefficients for feeding and cover. The birds in our study were residents, so we tested the year-long coefficients. Feeding and cover coefficients are the same for most birds.

We estimated abundance of birds in each vegetation structural stage as the sum of observations ≤50 m from the count station during the study. Tallies of bird abundance in mature multistoried ponderosa pine were multiplied by 1.167 to account for 6 versus 7 stands for the other structural stages. We calculated predicted abundance of birds in vegetation structural stages using coefficients in the HABCAP model with the following equation:

$$PN_j = \frac{C_{SS_{ij}}}{\sum_{1}^{n} C_{SS_{ij}}} X N_j.$$

where PN_j = predicted abundance of bird species j , C_{SSij} = HABCAP coefficient for species j in structural stage i, and N_j = the total abundance of species j. We tested the hypothesis that the HABCAP model explained the abundance of birds observed in structural stages using chi-square goodness-of-fit tests (Freese 1960). Chi-square tests were made only for structural stages with coefficients >0. A chi-square statistic with P ≤0.05 indicated lack of fit by the model. We then constructed 95% confidence intervals around the proportion of observations in each structural stage (Fleiss 1981). If the coefficient for a species for a structural stage was 0, a single observation resulted in failure of the model to fit for that structural stage.

HABCAP model coefficients were revised manually through iterations of the following process. Following a significant chi-square sta-

Table 2. Existing summer or year-long habitat capability model coefficients for nongame birds for ponderosa pine and aspen/birch structural stages in the Black Hills, South Dakota[1,2].

	Ponderosa pine[1]							Aspen/birch[1]				Meadows	
	Sapling-pole			Mature					Sapling-pole				
Birds	<40%	41–70%	>70%	<40%	41–70%	>70%	Multi-storied	Shrub-seedling	<40%	41–70%	>70%	Wet	Dry
Hairy woodpecker	1.0	0.7	0.3	0.7	0.5	0.4	0.7	0.0	0.4	0.7	0.7	0.0	0.0
Gray jay	0.1	0.2	0.2	0.3	1.0	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Black-capped chickadee	0.5	0.9	0.8	0.8	0.9	0.7	0.9	0.8	0.7	1.0	0.8	0.0	0.0
White-breasted nuthatch	0.2	0.5	0.3	0.2	0.4	0.3	0.3	0.0	0.1	0.2	0.2	0.0	0.0
Red-breasted nuthatch	0.5	0.5	0.8	0.3	0.8	0.8	1.0	0.1	0.1	0.2	0.4	0.0	0.0
Dark-eyed junco	0.9	0.6	0.2	1.0	0.5	0.4	0.4	1.0	0.7	0.6	0.5	0.5	0.5

[1] Based on year-long cover coefficients from Region 2 habitat capability model (unpublished data, Black Hills National Forest, Custer, South Dakota).

[2] Structural stage categories taken from Buttery and Gillam (1983).

tistic or when the expected proportion of abundance was outside the confidence interval for the observed proportion of abundance, new coefficients were assigned. We then recalculated the predicted abundance for each structural stage and computed a new chi-square test statistic and confidence intervals. For birds not included in the HABCAP model, we assigned a coefficient of 0.5 to all structural stages then tested these coefficients using the above process.

Results and Discussion

We observed 31 bird species during the winter in the Black Hills (appendix 1). Six species were sufficiently abundant and adequately distributed for statistical tests of HABCAP coefficients (table 2). Red crossbills (*Loxia curvistra*) were the most abundant winter bird, but the existing HABCAP model did not include coefficients for them. Our recommended final HABCAP model coefficients for these 7 species are in table 3. To simplify presentation of the data, tables displaying iterations of tests for HABCAP coefficients are on file at the Rapid City Research Laboratory.

Hairy Woodpecker

Hairy woodpeckers (*Picoides villosus*) were the only abundant primary cavity-nesting species observed during winter in the Black Hills. Summer HABCAP model coefficients for hairy woodpeckers adequately predicted ($P = 0.58$) the patterns of observed abundance among structural stages during winter. Coefficients depicting habitat capability generally declined in ponderosa pine as overstory canopy cover increased, except in the mature multistoried structural stage. In aspen/birch, coefficients reflecting abundance of hairy woodpeckers were larger in sapling-pole with >40% overstory canopy cover. Occasionally hairy woodpeckers were observed feeding in shrub-seedling aspen/birch and wet meadows, if these stands contain snags. Because the occurrence of hairy woodpeckers in these structural stages depended on a habitat attribute not directly associated with the vegetation features of these

Table 3. Final coefficients reflecting habitat capability of vegetation structural stages for 7 bird species during winter in the Black Hills, South Dakota[1, 2, 3].

	Ponderosa pine							Aspen/birch				Meadows	
	Sapling-pole			Mature					Sapling-pole				
Birds	<40%	41–70%	>70%	<40%	41–70%	>70%	Multi-storied	Shrub-seedling	<40%	41–70%	>70%	Wet	Dry
Hairy woodpecker	1.0	0.7	0.3	0.7	0.5	0.4	0.7	0.0	0.4	0.7	0.7	0.0	0.0
Gray jay	0.1	0.2	0.4	0.1	0.4	1.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Black-capped chickadee	0.8	0.8	0.7	0.8	0.6	0.8	1.0	0.4	0.7	0.6	0.6	0.0	0.0
White-breasted nuthatch	0.1	0.4	0.3	0.1	0.3	0.4	0.5	0.0	0.1	0.1	0.2	0.0	0.0
Red-breasted nuthatch	0.3	0.7	0.8	0.3	0.7	1.0	1.0	0.0	0.1	0.2	0.3	0.0	0.0
Dark-eyed junco	1.0	0.4	0.2	0.7	0.3	0.2	0.6	0.3	0.9	0.5	0.2	0.2	0.0
Red crossbill	1.0	0.7	0.6	0.6	0.6	0.7	0.5	0.0	0.0	0.0	0.4	0.0	0.0

[1] *Based on bird abundance during winter 1992–93 and 1993–94.*
[2] *Structural stage categories from Buttery and Gillam (1983).*
[3] *Coefficients for red crossbills were adjusted from estimated coefficients of 0.5 in all structural stages based.*

structural stages, the HABCAP coefficient for shrub-seedling aspen/birch and meadows should be 0.

Depending on abundance of large snags, hairy woodpeckers usually occur in interior portions of managed forests (Aney 1984) and old-growth stands (Marshall 1988). In the winter, hairy woodpeckers occur in smaller patches and in stands with multistoried canopies (Manual and Huff 1987, Chambers and McComb 1997). This species uses all stand conditions of temperate coniferous forests, but optimal habitat is in multistoried old-growth stands (Ohmann et al. 1994). The size and number of snags or number of suitable cavities probably describe habitat suitability for hairy woodpeckers (Cunningham et al. 1980, Zarnowitz and Manuwal 1985, Runde and Capen 1987) better than the vegetation structural stage.

Open ponderosa pine stands are the end product of timber harvest in the Black Hills. Aspen/birch stands are usually regenerated by clearcutting. Harvesting standing dead trees is permitted for personal firewood, and snags in stands with easy access to firewood cutters are usually cut. Thus, the HABCAP coefficients for hairy woodpeckers may reflect the abundance and size of snags following timber harvest.

Gray Jay

Mills et al. (1996) provided HABCAP coefficients for gray jays (*Perisoreus canadensis*) during the breeding season; structural stages with mature ponderosa pine with >40% overstory canopy cover were the optimal habitat for gray jays in the Black Hills. Patterns of gray jay abundance during winter differed ($P < 0.01$) from that predicted by the HABCAP model. Despite a coefficient of 0.9, more ($P < 0.01$) gray jays were observed in the mature ponderosa pine with 71 to 100% overstory canopy cover than predicted by the breeding season HABCAP model. The final coefficient for gray jays in mature ponderosa pine with 41 to 70% overstory canopy cover was less than that during the breeding season. The HABCAP coefficient for gray jays in sapling-pole ponderosa pine 71 to 100% overstory canopy cover also increased, relative to the coefficients from the breeding season. In Douglas fir (*Pseudotsuga menziesii*) forest, gray jays preferred old-growth stands that had the highest overstory canopy cover (Manuwal and Huff 1987). Overstory canopy cover in mature multistoried stands was higher than other structural stages of ponderosa pine, but it included overstory from numerous small trees (unpublished data, Rocky Mountain Research Station, Rapid City, SD). Thus, the HABCAP coefficient in mature multistoried ponderosa pine was lower than in mature ponderosa pine with >71% overstory canopy cover. Gray jays preferred the mature trees over sapling-pole trees.

Black-capped Chickadee

Black-capped chickadees were the most abundant passerine in this study; they were common in all ponderosa pine and aspen/birch structural stages of the Black Hills. Black-capped chickadees are tolerant of most habitat conditions but prefer unharvested stands during winter (Manuwal and Huff 1987, Chambers and McComb 1997). Abundance of black-capped chickadees among structural stages during winter differed ($P < 0.01$) from those predicted HABCAP coefficients developed during the breeding season (Mills et al. 1996) and applied to year-round use of structural stages. Black-capped chickadees occurred more frequently in sapling-pole ponderosa pine with 0 to 40% overstory canopy cover than predicted. Black-capped chickadees used sapling-pole ponderosa pine more than predicted by the breeding season model. Slight modifications to the HABCAP coefficients for chickadees were made for the other structural stages of ponderosa pine. Coefficients predicted greater use by Black-capped chickadees in the following structural stages of aspen: shrub-seedling, sapling-pole 41 to 70% overstory canopy cover, and sapling-pole >70% overstory canopy cover than was observed. Black-capped chickadees are limited by the abundance of suitable cavities for roosting (Balda 1970) to maintain their thermoregulation (Cunningham et al. 1980) during winter. Although we observed black-capped chickadees in wet meadows, their use of this structural stage was restricted to occasional use or feeding in small willow (*Salix* spp.) patches. Therefore, the HABCAP coefficients in this structural stage remained 0.

White-breasted Nuthatch

Observed abundance among structural stages of white-breasted nuthatches during winter differed ($P < 0.01$) from that predicted by year-round HABCAP coefficients estimated during the breeding season. However, only slight modifications were necessary to align HABCAP coefficients during winter with observed patterns. HABCAP coefficients indicated that ponderosa pine and aspen/birch provide moderate quality habitat for white-breasted nuthatches. Optimal habitat, according to the HABCAP coefficients, occurs in bur oak (*Quercus macrocarpa*) 0 to 40% overstory cover which were not included in this study. Winter HABCAP coefficients for white-breasted nuthatches were scaled to maintain the relative values to bur oak in the existing model. Abundance of white-breasted nuthatches in mature and sapling-pole ponderosa pine structural stages with ≤70% overstory canopy cover and mature multistoried structural stages of ponderosa pine were overestimated ($P < 0.01$) by the existing model. Within ponderosa pine, the structural stage with 41 to 70% overstory canopy cover had larger HABCAP coefficients than structural stages with ≤40% canopy closure or those with >71% canopy closure. In Arizona, white-breasted nuthatches selected dense, mature stands with large snags (Cunningham et al. 1980). We noted infrequent occurrence of white-breasted nuthatches in wet meadows. White-breasted nuthatches occasionally used small isolated patches of willows in meadow. HABCAP coefficients for meadow structural stages for white-breasted nuthatches remained 0.

Red-breasted Nuthatch

Red-breasted nuthatches prefer old-growth interior coniferous forests (Manuwal and Huff 1987, Ralph et al. 1991, Ohmann et al. 1994, Chambers and McComb 1997), but also occur in deciduous and mixed coniferous/deciduous habitats (DeGraaf et al. 1991). During the breeding season, habitat capability for red-breasted nuthatches increased with overstory canopy cover in both sapling-pole and mature structural stages of ponderosa pine, but optimal habitat was mature multistoried stands (Mills et al.1996). HABCAP coefficients in aspen/birch followed the same trends as in ponderosa pine, but with lower HABCAP coefficients. Abundance of red-breasted nuthatches among structural stages during winter differed ($P < 0.01$) from that predicted in the existing model. HABCAP coefficients in sapling-pole aspen birch 71–100% overstory canopy cover and 0–40% overstory canopy cover structural stages of sapling-pole and mature ponderosa pine were lower than during the breeding season. Mature ponderosa pine 71–100% overstory canopy cover and the mature multistoried ponderosa pine were optimal habitat for red-breasted nuthatches during winter.

Dark-eyed Junco

Logging appears to improve habitat for dark-eyed juncos. In Douglas-fir forests during winter, juncos were most abundant in stands that had three-fourths of the tree volume removed by logging (Chambers and McComb 1997). Although abundance of dark-eyed juncos during winter differed from that predicted by the HABCAP model ($P < 0.01$), general tendencies remained similar to those predicted by the breeding season coefficients in all structural stages except shrub-seedling aspen/birch. During winter, the abundance of dark-eyed juncos in shrub-seedling aspen/birch declined from that predicted by the coefficients developed during the breeding season. Because juncos feed on the ground in open forested stands (Smith and Andersen 1982), a small coefficient in meadows reflects feeding habitat only.

Red Crossbill

Red crossbills are short distance migrants that winter and breed in the Black Hills. Nesting occurs during the winter from late December through March (South Dakota Ornithologists' Union 1991); young are usually fledged by late spring when most other birds breed. Red crossbills are better adapted to winter existence than other passerines because their beaks are better suited for handling seeds (Cody 1985). Because of their winter breeding, red crossbills were not included in earlier spring breeding season tests of HABCAP coefficients (Mills et al. 1996). HABCAP coefficients from this study represent breeding habitat for red crossbills. Open ponderosa pine and spruce forests from 457 to 1,372 m in elevation are preferred habitat for red crossbills (Haldeman 1980). However, Manuwal and Huff (1987) reported red crossbills preferred "old growth" Douglas fir with high amounts of seeds.

Despite their adaptations for eating seeds from cones, ponderosa pine seed production may not have determined habitat selection for red crossbills. Coefficients depicting the observed abundance patterns of red crossbills among structural stages during winter suggested that they preferred open forest habitats. Ponderosa pine with 71 to 100% overstory canopy cover has greater seed production than stands with less overstory cover (Rumble and Anderson 1996). However, the sapling-pole ponderosa pine structural stage with 0 to 40% overstory canopy cover was optimal habitat. HABCAP coefficients declined with increasing overstory canopy cover in sapling-pole ponderosa pine. HABCAP coefficients for all mature structural stages of ponderosa pine were nearly the same. The 71 to 100% overstory canopy cover structural stage of sapling-pole aspen/birch provided moderate habitat capability for crossbills. Ponderosa pine occurs in many aspen/birch stands in the Black Hills and the aspen/birch is seral to ponderosa pine in some areas (Hoffman and Alexander 1987). Aspen/birch stands in narrow drainages often had ponderosa pine within or nearby. The suitability of aspen/birch for red crossbills depends on the co-occurrence of ponderosa pine.

Other Birds of Interest

Downy woodpeckers (*Picoides pubescens*) nest, roost, and feed in cavities. We observed

Table 4. Observations of 3 uncommon bird species of interest in vegetation structural stages during winter in the Black Hills, South Dakota.[1]

	Ponderosa pine							Aspen/birch				Meadows	
	Sapling-pole			Mature					Sapling-pole				
Birds	<40%	41–70%	>70%	<40%	41–70%	>70%	Multi-storied	Shrub-seedling	<40%	41–70%	>70%	Wet	Dry
Downy woodpecker	6	4	7	4	5	5	6	4	6	1	5	0	0
Brown creeper	1	0	2	0	0	0	4	0	0	0	0	0	0
Townsend's solitaire	1	2	0	9	12	3	5	0	0	0	0	0	0

[1] *Downy woodpeckers are cavity nesters and sensitive to snag densities, brown creepers are frequently cited in appeals of timber sales as requiring extensive areas of unmanaged, dense, large diameter forest (Rumble et al. submitted), and Townsend's solitaires were added to the summer habitat capability model (Mills et al. 1996).*

downy woodpeckers in all structural stages that were forested. Suitable habitats for downy woodpeckers include a wide variety of forest vegetation types and open woodlands if snags or dead tree limbs are available (DeGraaf et al. 1991). Similar to hairy woodpeckers, the cosmopolitan use of vegetation structural stages by downy woodpeckers in our study probably reflected the abundance and distribution of snags. Currently, there are no HABCAP coefficients for downy woodpeckers during winter. While our data are inadequate for developing coefficients, they could be used in the future with other data to develop HABCAP coefficients for downy woodpeckers.

Brown creepers (*Certhia americana*) are frequently cited in appeals of timber sales along with fragmentation issues (Rumble et al. submitted). Data do not support the requirements for large stands by brown creepers, but do support their selection of dense forest with large diameter trees (Gilbert and Allwine 1991, Hansen et al. 1995, Dykstra 1996, Mills et al. in press). Brown creepers were uncommon in our study and in studies conducted during the breeding season (Mills et al. submitted, Dykstra 1996). We believe that coefficients for habitat capability for brown creepers during winter should be 1.0 in mature and multistoried vegetation structural stages of ponderosa pine with canopy closure >70%. Other vegetation structural stages are unsuitable.

Townsend's solitaire (*Myadestes townsendii*) is a recent addition to the breeding season HABCAP model. Sapling-pole structural stages of ponderosa pine were better habitat for Townsend's solitaires during the breeding season. These data suggest that mature ponderosa pine with <70% overstory canopy cover provided better habitat than other structural stages of ponderosa pine for Townsend's solitaires. Pending better data and in lieu of using summer coefficients for Townsend's solitaires during winter, we recommend that winter HABCAP coefficients for sapling-pole ponderosa pine with ≤70% overstory canopy cover be 0.2, coefficients for mature ponderosa pine with ≤70% overstory canopy cover be 1.0, mature ponderosa pine with >70% overstory canopy cover and multisoried ponderosa pine be assigned coefficients of 0.5. Winter HABCAP coefficients for Townsend's solitaires in aspen/birch structural stages should be 0.

Conclusions and Management Implications

Deciduous woodland types, such as quaking aspen are key habitats for birds during the breeding season (Mills et al. 1996, Finch and Reynolds 1997). During winter, diurnal feeding and nocturnal conservation of energy are critically important to birds in northern latitudes because they only have food reserves for the upcoming night and part of the next day (King 1972, cited by Walsberg 1985). Thus, ponderosa pine is the key winter habitat for birds in the Black Hills. Of the bird for which we had adequate data, all had greater habitat capability coefficients in one or more structural stages of ponderosa pine than in aspen or meadows. Ponderosa pine provides greater thermoregulatory benefits for small birds (Walsberg 1985) than aspen. Greater production of ponderosa pine seeds in structural stages with >70% overstory canopy cover (Rumble and Anderson 1996) was reflected by the higher habitat capability in these structural stages for seed eating birds such as gray jays and nuthatches. Open canopy structural stages of ponderosa pine and aspen provided better habitats for ground foraging juncos; whereas, hairy woodpeckers and black-capped chickadees, which forage on insects on larger diameter woody material were less specific in their habitat requirements. Meadows and shrub-seedling vegetation structural stages were relatively unimportant to birds during the winter.

Forest management should sustain the distribution and availability of all forest vegetation structural stages to ensure that habitat requirements for wintering birds are met. Specifically, managers must understand the habitat needs of birds during winter (Morrison et al. 1995) because availability of winter habitat influences successful breeding and population persistence of resident birds (Huff et al. 1991, DellaSalla et al. 1996).

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Appendix 1. Birds observed on winter bird counts in the Black Hills, South Dakota during 1992 and 1993, and 1993 and 1994.

Common name	Genus species
Northern goshawk	*Accipiter gentilis*
Sharp-shinned hawk	*A. striatus*
Rough-legged hawk	*Buteo lagopus*
Red-tailed hawk	*B. jamaicensis*
Golden eagle	*Aquila chrysaetos*
Bald eagle	*Haliaeetus leucocephalus*
Merriam's turkey	*Meleagris gallopavo merriami*
Ruffed-grouse	*Bonasa umbellus*
Great horned owl	*Bubo virginianus*
Short-eared owl	*Asio flammeus*
Northern flicker	*Colaptes auratus*
Hairy woodpecker	*Picoides villosus*
Downy woodpecker	*P. pubescens*
Black-backed woodpecker	*P. arctus*
Blue jay	*Cyanocitta cristata*
Gray jay	*Perisoreus canadensis*
Black-billed magpie	*Pica pica*
American crow	*Corvus brachyrhynchos*
Black-capped chickadee	*Poecile atricapillus*
White-breasted nuthatch	*Sitta carolinensis*
Red-breasted nuthatch	*S. canadensis*
Brown creeper	*Certhia americana*
American robin	*Turdus migratorius*
Townsend's solitaire	*Myadestes townsendii*
Mountain bluebird	*Sialia currucoides*
Golden-crowned kinglet	*Regulus satrapa*
Northern shrike	*Lanius exubitor*
Common redpoll	*Carduelis flammea*
Pine siskin	*C. pinus*
Red crossbill	*Loxia curvirostra*
Dark-eyed junco	*Junco hyemalis*

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