

The Effects of Management Practices on Grassland Birds— Swainson's Hawk (*Buteo swainsoni*)

Chapter M of

The Effects of Management Practices on Grassland Birds



Professional Paper 1842–M

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Background photograph: Northern mixed-grass prairie in North Dakota, by Rick Bohn, used with permission.

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The Effects of Management Practices on Grassland Birds

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Contents

Acknowledgments.....	iv
Capsule Statement.....	1
Breeding Range.....	1
Suitable Habitat.....	1
Prey Habitat.....	3
Area Requirements and Landscape Associations.....	3
Brood Parasitism by Cowbirds and Other Species.....	3
Breeding-Season Phenology and Site Fidelity.....	4
Species' Response to Management.....	4
Management Recommendations from the Literature.....	6
References.....	6

Figure

M1. Map showing breeding distribution of the Swainson's Hawk (<i>Buteo swainsoni</i>) in the United States and southern Canada, based on North American Breeding Bird Survey data, 2008–12.....	2
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Conversion Factors

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
hectare (ha)	2.471	acre
square kilometer (km ²)	247.1	acre
hectare (ha)	0.003861	square mile (mi ²)
square kilometer (km ²)	0.3861	square mile (mi ²)

Abbreviations

DDE	dichlorodiphenyldichloroethylene
RSZ	rotor-swept zone
spp.	species (applies to two or more species within the genus)

Acknowledgments

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Capsule Statement

The key to Swainson’s Hawk (*Buteo swainsoni*) management is providing open grasslands that contain patches of trees for nesting and perching, sometimes near cultivated areas. Vernacular and scientific names of plants and animals follow the Integrated Taxonomic Information System (<https://www.itis.gov>).

Breeding Range

Swainson’s Hawks breed from southern British Columbia and eastern Washington, Oregon, and California; east to southwestern Manitoba and southwestern Minnesota; and south to northern Mexico (National Geographic Society, 2011). The relative densities of Swainson’s Hawks in the United States and southern Canada, based on North American Breeding Bird Survey data (Sauer and others, 2014), are shown in figure M1 (not all geographic places mentioned in report are shown on figure).

Suitable Habitat

Swainson’s Hawks prefer open grasslands with scattered trees or with small clumps of trees or shrubs (Bent, 1961; Bechard and others, 2010; Kennedy and others, 2014), sometimes near cultivated areas (Schmutz, 1987, 1989). The species uses shortgrass, mixed-grass, tallgrass, and sandhill prairies; aspen parklands; riparian areas; isolated trees; shelterbelts; woodlots; black-tailed prairie dog (*Cynomys ludovicianus*) colonies; pastures; hayland; cropland; and residential areas (Saunders, 1914; Bent, 1961; Jacobson, 1972; Stewart,



Swainson’s Hawk. Illustration by Christopher M. Goldade, U.S. Geological Survey.

1975; Dunkle, 1977; Emmerich, 1978; Johnsgard, 1980; Clark and others, 1982; Faanes, 1983; Gilmer and Stewart, 1984; Schmutz, 1987; Cable and others, 1992; James, 1992; Leslie, 1992; Andersen, 1995; Babcock, 1995; Faanes and Lingle, 1995; Smallwood, 1995; Bosakowski and others, 1996; Haas, 1997; Prescott, 1997; Martell and others, 1998; Schmutz and others, 2006). In Alberta, Swainson’s Hawks were most common in shelterbelts, followed by upland shrublands, mixed-grass pastures, tame pastures, hayland, fallow cropland, upland trees, and cropland (Prescott, 1997).

Swainson’s Hawks nest in trees and shrubs that are either isolated, clumped, or part of shelterbelts or windbreaks (Cameron, 1913; Saunders, 1914; Bent, 1961; Olendorff, 1973;

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2 The Effects of Management Practices on Grassland Birds—Swainson’s Hawk (*Buteo swainsoni*)

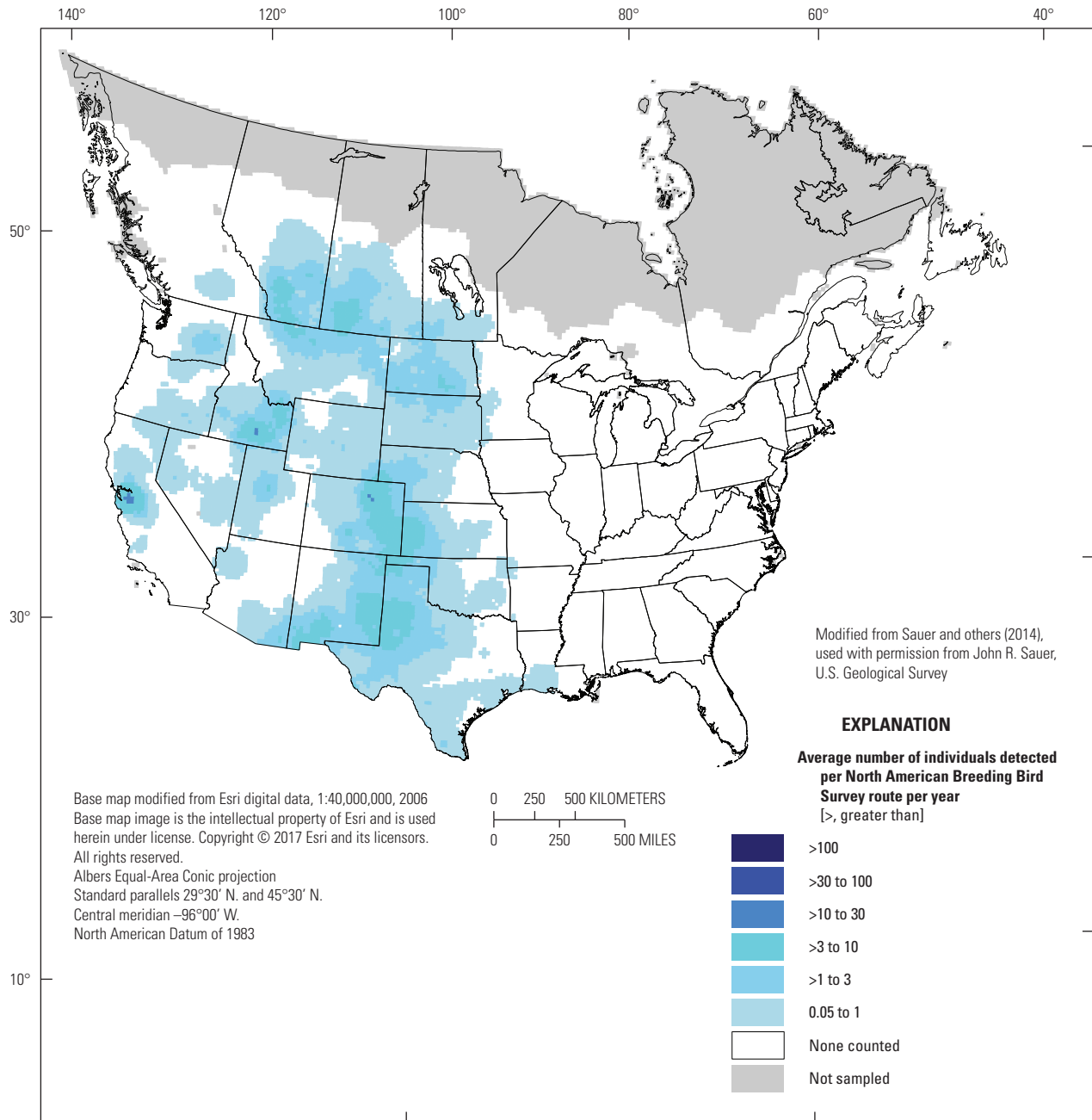


Figure M1. Breeding distribution of the Swainson’s Hawk (*Buteo swainsoni*) in the United States and southern Canada, based on North American Breeding Bird Survey (BBS) data, 2008–12. The BBS abundance map provides only an approximation of breeding range edges.

Maher, 1974; Salt and Salt, 1976; Dunkle, 1977; Johnsgard, 1980; Green and Morrison, 1983; Thurow and White, 1983; Schmutz, 1984; Murphy, 1991, 1993; Cable and others, 1992; Hansen, 1994; Faanes and Lingle, 1995; Hansen and Flake, 1995; Haas, 1997; Martell and others, 1998; Schmutz and others, 2006; Kennedy and others, 2014). In North Dakota, Stewart (1975) and Gilmer and Stewart (1984) reported that Swainson’s Hawks nested in isolated trees, thickets of native trees, shelterbelts, tree claims (clumps of trees other than one- or two-row shelterbelts), wetland borders, rights-of-way,

coulees, abandoned farmsteads, active farmsteads, and in areas of cropland or native prairie that include brushy margins of native forested tracts. In another North Dakota study, nest trees within tree clumps were an average of 8.3 meters (m) from the edge of the clumps (Murphy, 1993). In a South Dakota study that evaluated bird use of several categories of wooded areas, Swainson’s Hawks preferred tree claims (non-linear plantings of trees at least 2.1 hectares [ha] that were not planted in rows) that were characterized as dense tree stands with a sparse to dense shrub layer and that were ungrazed or

lightly grazed (Emmerich, 1978). In Wyoming, nest trees were in dry grasslands, irrigated meadows, or near the edges of these habitat types (Dunkle, 1977). In Idaho, most nest trees were within 40 m of another tree (Hansen, 1994). Of 157 nests in Colorado, 63 were in lone trees, 56 were in small groves of less than (<) 10 trees, and 38 were in large groves of 10 or more trees (Leslie, 1992).

Nest heights above ground ranged from 0 to 18 m, with averages among studies ranging from 2.4 to 10.1 m (Bent, 1961; Stewart, 1975; Dunkle, 1977; Schmutz, 1977; Munro and Reid, 1982; Bechard, 1983; Green and Morrison, 1983; Gilmer and Stewart, 1984; Restani, 1991; Murphy, 1993; Hansen, 1994; Bosakowski and others, 1996), whereas heights of nest trees ranged from 2 to 22 m (Green and Morrison, 1983; Restani, 1991; Leslie, 1992; Murphy, 1993; Hansen, 1994; Bosakowski and others, 1996). Diameter at breast height of nest trees averaged 21.4–53.2 centimeters (cm) (Leslie, 1992; Murphy, 1993; Hansen, 1994). The average slope of the terrain around 42 nest trees in Montana was 7 percent (Restani, 1991). In Wyoming, the most successful nests of 49 total nests were the six lowest (those <2.5 m above the ground) (Dunkle, 1977).

Tree and shrub species used as nesting substrates include oneseed juniper (*Juniperus monosperma*), Utah juniper (*Juniperus osteosperma*), cottonwood (*Populus* species [spp.]), narrowleaf cottonwood (*Populus angustifolia*), oak (*Quercus* spp.), bur oak (*Quercus macrocarpa*), elm (*Ulmus* spp.), Chinese elm (*Ulmus parvifolia*), American elm (*Ulmus americana*), water birch (*Betula occidentalis*), poplar (*Populus* spp.), balsam poplar (*Populus balsamifera*), peachleaf willow (*Salix amygdaloides*), quaking aspen (*Populus tremuloides*), boxelder (*Acer negundo*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), black locust (*Robinia pseudoacacia*), Saskatoon serviceberry (*Amelanchier alnifolia*), silver buffaloberry (*Shepherdia argentea*), peashrub (*Caragana* spp.), prickly rose (*Rosa acicularis*), maple (*Acer* spp.), hawthorn (*Crataegus* spp.), plum (*Prunus* spp.), cedar (*Juniperus* spp.), Russian olive (*Elaeagnus angustifolia*), chokecherry (*Prunus virginiana*), Black Hills spruce (*Picea glauca*), blue spruce (*Picea pungens*), Douglas-fir (*Pseudotsuga menziesii*), red pine (*Pinus resinosa*), ponderosa pine (*Pinus ponderosa*), and pinyon pine (*Pinus edulis*) (Cameron, 1913; Saunders, 1914; Bent, 1961; Maher, 1974; Stewart, 1975; Salt and Salt, 1976; Dunkle, 1977; Bechard, 1983; Thurow and White, 1983; Gilmer and Stewart, 1984; Restani, 1991; Hansen, 1994; Andersen, 1995; Hansen and Flake, 1995; Martell and others, 1998; Schmutz and others, 2001, 2006; Coates and others, 2014). Swainson's Hawks occasionally nest on artificial nest platforms or on the ground (Bent, 1961; Stewart, 1975; Salt and Salt, 1976; Schmutz, 1977; Schmutz and others, 1984; Coates and others, 2014). In Saskatchewan, Swainson's Hawks nested on shelves of cutbanks in open country (Bent, 1961). Swainson's Hawks have been

reported nesting on the crossbars of telephone poles and on railway signal gantries (Dunkle, 1977; James, 1992).

Prey Habitat

Swainson's Hawks prey primarily on insects and small mammals (Cameron, 1913; Olendorff, 1973; Salt and Salt, 1976; Dunkle, 1977; Schmutz, 1977; Bechard, 1983; Gilmer and Stewart, 1984; Torrance, 1986; Johnson and others, 1987; McGrath, 1988; Houston, 1990, 1995, 1998; Restani, 1991; James, 1992; Hansen, 1994; Giovanni and others, 2007; Behney and others, 2010). Other prey items include birds, fish, reptiles, and amphibians (Cameron, 1913; Krause, 1968; Olendorff, 1973; Dunkle, 1977; Schmutz, 1977; Gilmer and Stewart, 1984; Torrance, 1986; Restani, 1991; Hansen, 1994; Andersen, 1995; Knopf and Wunder, 2006; Giovanni and others, 2007; Behney and others, 2010). In Idaho, a summer flock of nonbreeding Swainson's Hawks (which varied over time between 31 and 238 birds) was attracted to a grasshopper (*Melanoplus* spp.) infestation in June (Johnson and others, 1987). Based on pellet analysis, each hawk fed on an estimated 100 grasshoppers per day and consumed an estimated 310,000 grasshoppers while in the study area. In Saskatchewan, numbers of Swainson's Hawks increased during a year of peak vole (*Microtus* spp.) numbers and remained high during the following year (Poulin and others, 2001).

Area Requirements and Landscape Associations

Estimates of home-range size vary from 6.2 to 27.3 square kilometers (km²) (Schmutz, 1977; Bechard, 1982; Andersen, 1995). In Colorado, males had larger (31.7 km²) home ranges than females (19.9 km²) (Andersen, 1995). In Alberta, the average minimum radius of a nesting territory was 0.35 kilometer (km), with the assumption that each nesting territory was circular and was centered on the nest site (Schmutz, 1977).

Brood Parasitism by Cowbirds and Other Species

The Swainson's Hawk is an unsuitable host of the Brown-headed Cowbird (*Molothrus ater*), and no known records of brood parasitism exist for this species (Shaffer and others, 2019).

Breeding-Season Phenology and Site Fidelity

Swainson's Hawks typically are present in breeding areas from late March to early May through late November (Cameron, 1913; Olendorff, 1973; Maher, 1974; Salt and Salt, 1976; Janssen, 1987; Houston, 1990; Hansen, 1994; Martell and others, 1998). Swainson's Hawks arrive on their breeding grounds in Nebraska as early as January and depart as late as December (Johnsgard, 1980). Swainson's Hawks are known to renest following a nesting failure (Olendorff, 1973; Leslie, 1992). Fidelity to former mates and nest sites has been documented (Houston, 1990; Schmutz, 1991; Andersen, 1995). The species often reuses nests built in previous years (Hansen, 1994; Martell and others, 1998). In Alberta, Swainson's Hawks did not change mates or territories in the breeding season following a year of unsuccessful reproduction (Schmutz, 1991).

Species' Response to Management

Few researchers have examined the effects of burning, mowing, or grazing on Swainson's Hawks, but a number of researchers have investigated the effect of surrounding land use on nest placement and reported that the proportion of cultivated land and grasslands near nest sites was an important factor in nest placement (Gilmer and Stewart, 1984; Schmutz, 1984, 1987, 1989; Groskorth, 1995; Smallwood, 1995; Bosakowski and others, 1996). Swainson's Hawks may place nests in landscapes with very little cropland, because of greater prey densities, or landscapes with a large amount of cropland, because of the ease with which prey can be captured in harvested fields (Groskorth, 1995). In southeastern Alberta, Swainson's Hawks preferred cultivated lands over grasslands (Schmutz, 1987, 1989). Swainson's Hawks tolerated extensive (as much as 90 percent) cultivation in the landscape surrounding nest sites as long as at least 10 percent remained in native grassland. Habitat use was examined within 41-km² plots in which the primary land use was cattle grazing or cultivation of cereal grains; cultivation on 80 plots ranged from 0 to 99 percent (Schmutz, 1989). Nest densities were higher in areas with 11–30 percent cultivation than in areas with <11 percent cultivation (Schmutz, 1984). Nest densities increased as cultivation increased to 30 percent and then showed no further change (Schmutz, 1989). Of 37 pairs that nested within 1 km of cultivated fields, 57 percent reared two or more young, compared to 28 percent of pairs that nested greater than (>) 1 km from cultivated fields and also reared two or more young (Schmutz, 1987). In contrast, in the Regina Plain of Saskatchewan, Groskorth (1995) reported that Swainson's Hawks nested in areas with more grasslands, trees, and shrubs and fewer wheat (*Triticum* spp.) fields within 1 km of nest sites than within random sites. Of 34 nest sites, 11 were in areas where the

percentage of wheat within 1 km of the nest site was <5 percent, but 15 nest sites were in areas with >75 percent wheat surrounding the nest site. In a Manitoba landscape dominated by agriculture, four nests were surrounded by cropland, and four were surrounded by native grasslands or pastures (Munro and Reid, 1982). For 27 nests in North Dakota, land use was recorded within 100 m and within 1 km of nests (Gilmer and Stewart, 1984). Mixed-grass pastures and hayland were the dominant land uses within 100 m and 1 km of nest sites. Some nesting Swainson's Hawks were more tolerant of agricultural land use: two pairs placed nests in areas where cropland within 1 km of the nest sites was >60 percent, and two pairs nested in sites that were surrounded by cultivated crops within 100 m. Of 157 nests found in the Pawnee National Grassland in Colorado, 118 were in grasslands, 25 were in abandoned cropland fields, and 14 were in cultivated lands (Leslie, 1992). In southern New Mexico, Swainson's Hawks were found in desert segments of roadside survey routes but not in residential, irrigated agricultural, or desert-agricultural edge segments (Kimsey and Conley, 1988).

The response of nesting Swainson's Hawks to human disturbance varies. In agricultural areas in Saskatchewan, nests were farther from buildings and water and were closer to human communities >2 km² in size than to human communities <2 km² in size; large human communities may have been attractive to hawks because of higher tree densities near human habitations (Groskorth, 1995). In fairly undisturbed shrubsteppe in Idaho, nesting pairs had more primary and secondary roads near their nests than did random points (Hansen, 1994). The mean distance from a nest to buildings was 8.9 km, to primary roads was 3.4 km, and to secondary roads was 2.8 km. The mean length of road within 3 km of nests was 20.6 km. In Wyoming, the species did not nest near houses (Dunkle, 1977). Within and adjacent to the Pawnee National Grassland in Colorado, 90 nests were in natural settings such as creek bottoms or grasslands, whereas 60 nests were in trees near human-created structures such as abandoned farmsteads, ditches, and created ponds (Olendorff, 1973). Swainson's Hawks nested near abandoned farmsteads more often than near other human-created structures. Nests on the Pawnee National Grassland had higher apparent nest success (not statistically tested) than nests on private lands. Nests in remote areas or on posted land (that is, with limited human access or where no trespassing was allowed) were more successful than easily accessible nests or nests near unposted land. Nests placed near unimproved roads (trails used by farmers and ranchers) were more successful than nests placed near improved (paved or gravel) roads, and nests placed near posted roads were more successful than nests placed near unposted roads (Olendorff, 1973). Also in Colorado, Swainson's Hawks, Golden Eagles (*Aquila chrysaetos*), and Ferruginous Hawks (*Buteo regalis*) showed significant changes in their home ranges as a result of military activity (Andersen and others, 1990). In comparison to birds that had not been exposed to military activity, birds that had been exposed to military activity showed greater shifting of home-range

centers, greater July-to-August increases in home-range sizes, and more frequent and greater movements outside of their territories.

Individual Swainson's Hawks respond differently to human disturbances (Dunkle, 1977), and the tendency towards nest desertion seems to vary regionally (Fyfe and Olendorff, 1976). Fyfe and Olendorff (1976) reported that in northeastern Colorado, Swainson's Hawks that were disturbed during late incubation did not desert their nests. Dunkle (1977) found that some female hawks would allow a human to approach within a few meters of the nest tree before flushing, whereas other hawks would stay several hundred meters away when a human was near the nest tree. Males usually stayed twice as far away as females. About one-third of incubating females would not flush from their nests unless the observer climbed the nest tree, whereas brooding females frequently would flush from nests if a human walked nearby. In Alberta, Swainson's Hawks flushed from their nests when humans approached to within an average of 18 m (range=2–100 m; $n=52$ nests) of the nest tree (Schmutz, 1987). Cameron (1913) reported that one female Swainson's Hawk would tolerate people standing directly under the nest tree, even when the people were talking loudly.

Beston and others (2016) identified the Swainson's Hawk as a species most likely to experience population declines from wind facilities, based on a prioritization system that included metrics of turbine risk. Wulff and others (2016) examined diurnal flight heights of Swainson's Hawks and determined that the species' mean flight height was 79.3 m, which is within the rotor-swept zone (RSZ; 32–124 m) of wind turbine blades. Wulff and others (2016) concluded that the Swainson's Hawk was at risk of turbine collisions because 95-percent confidence intervals for mean flight height were within the RSZ, and 54 percent of the species' flight heights were within the RSZ. In Oregon, Kolar and Bechard (2016) reported no effect of wind turbines on nest success of Swainson's Hawks. No fatalities for radio-marked fledglings were attributed to wind turbines, but juveniles that hatched from nests in areas of greater turbine density were more likely to die from depredation or starvation after fledging and before becoming independent compared to juveniles in areas of lower turbine density. Three adult nesting Swainson's Hawks from three separate nests collided with turbine blades. Two of the nests failed and the third produced one fledgling, which reached independence with food provisioning from the remaining adult.

In Idaho, the alteration and fragmentation of shrubsteppe landscapes by energy development have changed the nesting patterns of raptor species (Coates and others, 2014). Common Ravens (*Corvus corax*) and Red-tailed Hawks (*Buteo jamaicensis*) are displacing Swainson's Hawks; ravens, in particular, are exploiting anthropogenic structures such as electrical transmission towers as a nesting substrate, boosting their numbers and competitiveness over Swainson's Hawks. Although Swainson's Hawks readily nested in proximity to agricultural areas, so too did Common Ravens. Ravens and

Red-tailed Hawks also were more likely to nest near habitat edges than Swainson's Hawks, which chose natural nest sites in areas of contiguous grassland. Thus, shrubsteppe fragmentation by energy development favored the expansion of Common Ravens and Red-tailed Hawks over Swainson's Hawks (Coates and others, 2014).

Swainson's Hawks may be susceptible to pesticides and to lead poisoning because the species often forages heavily on insects during outbreaks in agricultural areas and on small mammals in grasslands (Knopper and others, 2006; Bechard and others, 2010). Of 17 hawk eggs collected in the prairie regions of Canada during a 23-year period of extensive organochloride use, three eggs had critical levels (that is, lowest levels at which productivity is affected) of dieldrin and one egg had critical levels of heptachlor epoxide (Noble and Elliot, 1990). Eggs from Saskatchewan and Alberta showed significant declines in dieldrin levels by 1988, but levels of dichlorodiphenyldichloroethylene (DDE) and heptachlor epoxide had not declined. In western Saskatchewan, unhatched eggs in nests of Swainson's Hawks were examined for possible effects of pesticide contamination; organochlorine pesticides were not found to be responsible for lack of hatching (Houston and others, 1991). Of 16 eggs collected in North Dakota and South Dakota during a 4-year period in the 1970s, 75 percent contained residues of DDE, 50 percent contained residues of dieldrin, 44 percent contained residues of heptachlor epoxide, and 6 percent contained residues of polychlorinated biphenyls (Stendell and others, 1988). Eggs contained 0.03 part per million of mercury. These contaminant levels were thought to be too low to have detrimental effects on the birds, and no contaminants were related to eggshell thinning. In a continent-wide survey of 734 raptors killed by pesticides, 20 Swainson's Hawks were killed in the United States from labeled pesticide uses (uses that are in accordance with the labeled instructions) as a result of hawks eating poisoned insects (Mineau and others, 1999). Deaths of Swainson's Hawks have been linked to pesticides used in the production of cotton (*Gossypium* spp.) and corn (*Zea mays*), and organophosphate pesticides associated with deaths have included terbufos (*S-tert-butylthiomethyl O,O-diethyl phosphorodithioate*) and disulfoton (*O,O-diethyl S-[2-(ethylthio)ethyl]phosphorodithioate*), among others.

Swainson's Hawks will sometimes scavenge animals shot for recreation or pest control (Knopper and others, 2006; Pauli and Buskirk, 2007; Herring and others, 2016). Lead bullet fragments can remain in the carcasses and can be ingested by scavenging raptors, exposing the birds to lead poisoning (Knopper and others, 2006; Pauli and Buskirk, 2007). Differences in bullet type influence potential scavenger exposure, with some bullet types retaining more bullet fragment mass, and these types of bullets may put Swainson's Hawks at risk of lead-induced behavioral and physiological impairment (Herring and others, 2016).

Management Recommendations from the Literature

Swainson's Hawks have declined in many rural areas where loss of nesting and foraging habitats to human development has been extensive, and effective conservation and management efforts to protect these habitats may require the collaboration of private landowners and public agencies (Schmutz and others, 2001; Bechard and others, 2010). In the absence of large tracts of native prairie, Swainson's Hawks will nest in small patches of natural or seminatural cover containing trees near cultivated areas (Schmutz, 1987). In fragmented habitats or habitats subject to anthropogenic structures such as transmission lines, the two habitat generalists, the Common Raven and the Red-tailed Hawk, may displace Swainson's Hawks in traditional nesting areas (Coates and others, 2014). The protection of nest trees is especially important because artificial nests are not readily used by Swainson's Hawks (Bechard and others, 2010; Coates and others, 2014). If necessary, wire-basket nest structures may be placed around existing nests to reduce destruction of the nests by wind, and livestock enclosures can be built around existing stands of trees to protect nest sites from livestock (Olendorff and Stoddart, 1974). Where trees are scarce, planting for future pairs of nesting Swainson's Hawks may be advisable (Bechard and others, 2010). In some situations, artificial nests may be beneficial and may provide nesting opportunities where nest trees are scarce (for example, near cultivated lands; Olendorff, 1973).

Swainson's Hawks are variably sensitive to disturbance during the nesting season (Dunkle, 1977; Groskorth, 1995), but disturbance should be minimized during the nest-building and incubation periods (Bechard and others, 2010). Swainson's Hawks are susceptible to pesticide poisoning as a result of labeled uses (Mineau and others, 1999); Bechard and others (2010) recommend using low-toxicity pesticides if application is necessary. In regions where prairie dogs or ground squirrels are shot for recreation or pest control, use of nontoxic bullets or of bullets that do not retain much fragment mass, and collection and disposal of carcasses, can reduce the threat of lead poisoning to scavenging Swainson's Hawks (Knopper and others, 2006; Pauli and Buskirk, 2007; Herring and others, 2016).

To prevent collisions of Swainson's Hawks with wind turbines, Wulff and others (2016) recommended avoiding wind-turbine placement in locations with high concentrations of trees or shrubs that provide nesting and perching habitat and avoiding placement in locations with high prey densities, such as prairie dog towns, in which hawks concentrate their foraging activities. Kolar and Bechard (2016) cautioned that a high density of wind turbines near Swainson's Hawk nesting habitat could lower reproductive success and that placement of wind turbines near nesting habitat should be avoided.

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