

# SAGE THRASHER

*Oreoscoptes montanus*

Original<sup>1</sup> prepared by Martin Gebauer

## Species Information

### Taxonomy

The Sage Thrasher is the only species in the genus *Oreoscoptes* and no subspecies are recognized (Cannings 1998). It is likely more closely related to the mockingbirds of the genus *Mimus* than to thrashers in the genus *Toxostoma* (Reynolds et al. 1999).

### Description

White wing bars, a white-cornered tail, and distinctive yellow eyes are distinguishing field marks of the Sage Thrasher. Plumage colouration is greyish-brown above and boldly streaked below. Worn late-summer birds show much less streaking. The bill is rather thrush-like and the tail is short for a thrasher. A poorly defined pale eyebrow line is also present (Godfrey 1986; NGS 1999).

### Distribution

#### Global

The Sage Thrasher breeds from extreme south-central British Columbia, central Idaho, and south-central Montana south through the Great Basin to north-eastern Arizona, west-central and northern New Mexico, northern Texas, and western Oklahoma (Reynolds et al. 1999). It has also bred in southeastern Alberta and southern Saskatchewan (Godfrey 1986). The Sage Thrasher winters from central California, southern Nevada, northern Arizona, central New Mexico, and central Texas south to Baja Mexico and central Mexico (Howell and Webb 1995; Campbell et al. 1997; Reynolds et al. 1999).

### British Columbia

In British Columbia, the Sage Thrasher is still reported annually from the Chopaka border crossing along Nighthawk Road, in the Richter Pass/Kilpoola Lake area, and almost annually from White Lake near Oliver (Nelson 1993; Cannings 2000). Singing birds have been reported from Vernon, the Thompson Valley at Lac du Bois, the Fraser Valley near Spences Bridge, and recently east of Oliver (Cannings 2000). A recent interesting record was of an old nest found west of Cache Creek along the Fraser River (Campbell et al. 1997), the first indication of breeding in this area.

#### Forest region and district

Southern Interior: Okanagan Shuswap

#### Ecoprovinces and ecoregions

SOI: NOB, OKR, PAR, SOB, THB

#### Biogeoclimatic units

BG: xh1, xh2

IDF: xh1

PP: xh1, xh2a

#### Broad ecosystem units

AB, BS, CF, DP, SS

#### Elevation

300–500 m

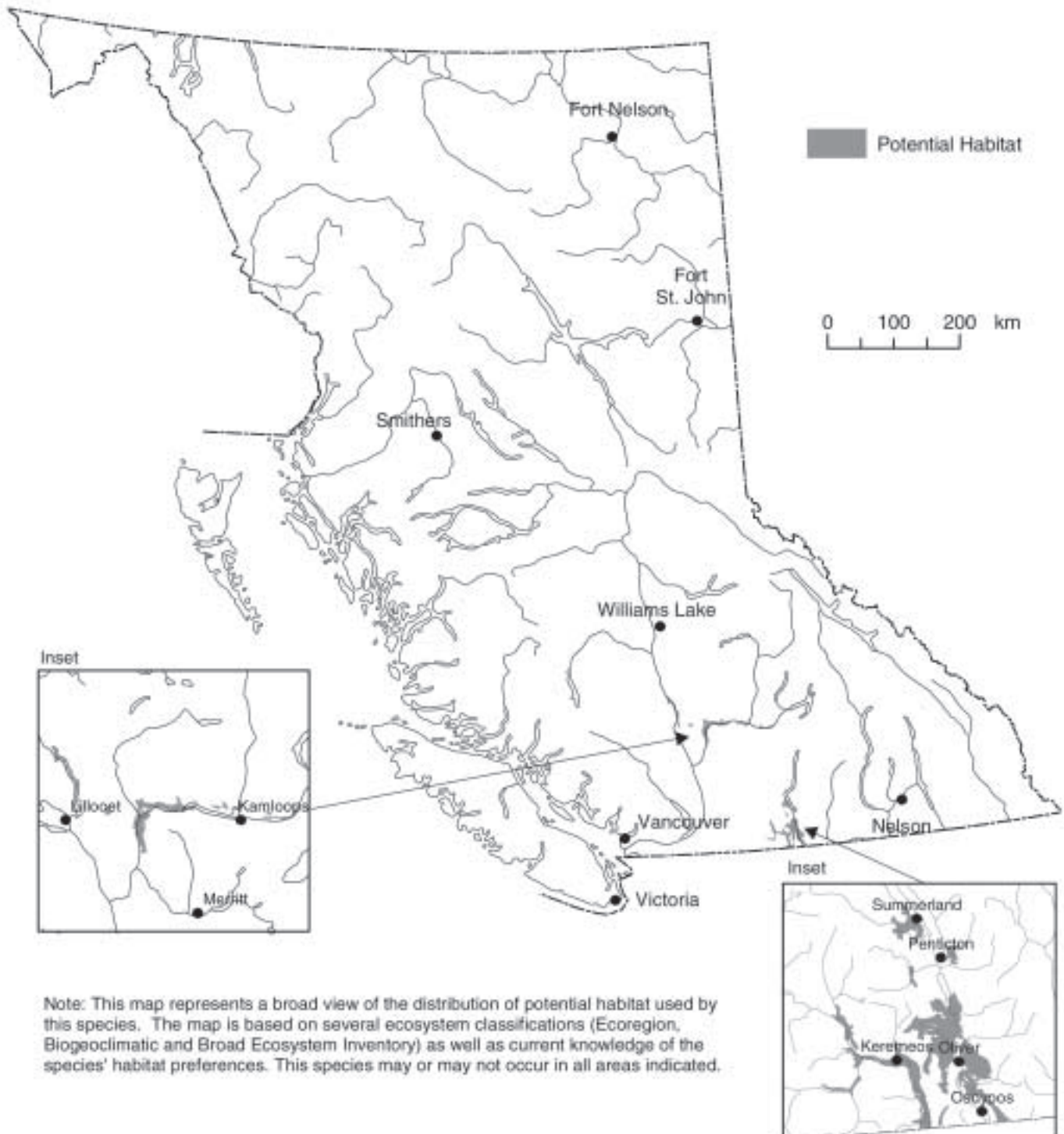
### Life History

#### Diet and foraging behaviour

Since the diet consists of insects and other terrestrial invertebrates, as well as small fruits, especially berries (Dobkin 1992; Paige and Ritter 1999), the Sage Thrasher is considered to be an opportunistic feeder rather than a specialist (Reynolds et al. 1999).

<sup>1</sup> Volume 1 account prepared by R. Millikin.

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Note: This map represents a broad view of the distribution of potential habitat used by this species. The map is based on several ecosystem classifications (Ecoregion, Biogeoclimatic and Broad Ecosystem Inventory) as well as current knowledge of the species' habitat preferences. This species may or may not occur in all areas indicated.

Sage Thrashers forage on the ground and glean from foliage (Dobkin 1992). They have been observed feeding at an ant mating swarm, digging for crickets and eating eggs, eating locusts and ants, eating saskatoon (*Amelanchier alnifolia*) berries, and breaking skin and eating from ripe grapes (Bent 1948; Stephens 1985; Nelson 1993; Blood 1995, Reynolds et al. 1999). Stephens (1985) provides a detailed analysis of Sage Thrasher diet in central Washington.

## Reproduction

In British Columbia, dates for 21 clutches ranged from 1 June to 28 July, with 65% between 15 and 22 June. Clutch size ranged from one to five eggs with 71% having four or five eggs (Campbell et al. 1997). Reynolds (1981), Reynolds and Rich (1978), and Gooding (1970, cited by Reynolds et al. 1999) have reported average clutches of 3.5, 3.8, and 4.1, respectively. Clutches of up to seven eggs have been reported (Bent 1948). Incubation period ranges from 13 to 17 days with a mean of 15 days (Reynolds and Rich 1978; Reynolds 1981; Ehrlich et al. 1988). In British Columbia, dates for 15 broods ranged from 18 June to 11 August (Campbell et al. 1997). Brood sizes ranged from one to five young with 87% having two to four young. The nestling period generally ranges from 10 to 14 days (Reynolds 1981; Ehrlich et al. 1988; Campbell et al. 1997). Double brooding occurs occasionally (Reynolds 1981; Cannings et al. 1987).

Cowbird parasitism was not found in 24 nests with eggs or young in British Columbia (Campbell et al. 1997), and has only been reported once in other areas (Friedmann and Kiff 1985), likely because Sage Thrashers reject cowbird eggs quickly (Rich and Rothstein 1985).

## Site fidelity

No information on nest site fidelity is available; however, Sage Thrashers regularly occur at several sites.

## Home range

Mean territory sizes for two successive years in southeastern Idaho were 1.14 and 1.86 ha, respect-

ively, with density estimates of 0.88 and 0.54 birds/ha, respectively (Reynolds 1981). Reynolds and Rich (1978) found territory sizes in Idaho ranging from 0.64 to 1.64 ha. In Washington, density estimates were 0.204 birds/ha in 1988, 0.212 in 1989, and 0.09 in 1990 (Dobler et al. 1996). In east-central Nevada, density estimates ranged between 0.12 and 0.4 birds/ha between 1981 and 1983 (Medin 1992). In the south Okanagan, territory sizes of 6–8 ha have been reported (R. Millikin, pers. comm., cited by Campbell et al. 1997).

## Movements and dispersal

Migrants arrive in the Okanagan Valley as early as the first week of April, but typically in May or even early June (Campbell et al. 1997). Sage Thrashers appear to leave in late August or early September with the latest date being 29 September (Cannings et al. 1987; Cannings 2000).

No information is available on initial dispersal of birds from natal sites (Reynolds et al. 1999).

## Habitat

### Structural stage

2: herb

3a: low shrub

## Important habitats and habitat features

### Nesting

The Sage Thrasher is almost entirely dependent on sagebrush habitats during the breeding season (Braun et al. 1976; McAdoo et al. 1989; Knick and Rotenberry 1995a; Dobler et al. 1996), although breeding birds are occasionally noted in other shrub-steppe habitats and antelope-brush (*Purshia tridentata*) (Reynolds et al. 1999). Generally, abundance of breeding birds is positively correlated with sagebrush cover and negatively correlated with annual grasses (Wiens and Rotenberry 1981; Reynolds et al. 1999). Sites with medium-sized sagebrush (30–60 cm high), with some larger sagebrush (>1 m) for nesting are preferred (Rich 1980; Wiens and Rotenberry 1981; Castrale 1982; Petersen and Best 1991; Campbell et al. 1997; Paige and Ritter

1999). Shrub cover >15–20% may be important (Cannings 2000).

Nineteen nests in British Columbia ranged from 8 to 154 cm off the ground (Campbell et al. 1997) compared with most nests in south-central Idaho which were placed on the ground (Reynolds and Rich 1978; Rich 1978). Nests found by R. Millikin (pers. comm.) in the south Okanagan were a minimum of 26 cm off the ground. R. Millikin (pers. comm., cited by Campbell et al. 1997) found that sagebrush (*Artemisia tridentata*) selected by thrashers in the south Okanagan was larger (i.e., larger total height and width) than surrounding shrubs and larger than randomly selected shrubs on census transects, and that the mean density of sagebrush canopy at nest sites was approximately 70%. For nesting, individuals select shrubs that have the greatest total height (mean of 132 cm) and crown width (mean of 168 cm) and have a full crown (i.e., with no gaps). In several studies in Idaho, mean nest shrub height averaged from 69 to 89 cm with nests placed at 10–30 cm from the ground (Rich 1980; Reynolds 1981) and in larger shrubs than are available at random (Petersen and Best 1991). Castrale (1982) also found Sage Thrashers in habitat patches containing the largest shrubs, whereas McAdoo et al. (1989) did not find a correlation between Sage Thrasher abundance and shrub height. The most important factor in nest placement seems to be the amount of cover above the nest; nests are placed just below the densest vegetation in vertical profile (Rich 1978; Rich 1980; Reynolds 1981; Castrale 1982). Petersen and Best (1991) found that all nest bushes were 75% or more live and had few gaps in either the vertical or the horizontal profile. Large, continuous areas of sagebrush also appear to be important (MELP 1998).

The primary plant species used for nesting is sagebrush (Campbell et al. 1987). Other nest tree species reported in the Okanagan included an orchard peach tree (Cannings et al. 1987), red hawthorn (*Crateagus columbiana*), and saskatoon (*Amelanchier alnifolia*) (Campbell et al. 1997). Rabbitbrush, (*Ericameria bloomeri*) antelope-brush, and juniper (*Juniperus* spp.) have also been used for nesting in the United States (Blood 1995). The nest is a bulky

structure comprised of sagebrush twigs, rootlets, bark strips, and plant stems, and lined with strips of sagebrush bark, fine grasses, horse and cattle hair, and fine rootlets (Cannings et al. 1987; Campbell et al. 1997). Several nests in the Okanagan were placed in trees with branches broken horizontally and nests were placed so that these branches would shade the nest from the sun (Cannings et al. 1987). R. Millikin (pers. comm.) found that cover above the nest was a critical habitat attribute. Shade platforms, constructed of twigs, are sometimes placed over the nest. A nest at White Lake had no shade platform when it was found with a clutch of five eggs, but 8 days later, when five young were present, a platform had been constructed with the addition of a twig “porch” as well (Cannings et al. 1987).

### **Foraging**

During the breeding season, the Sage Thrasher breeds almost entirely in sagebrush habitats. During the non-breeding season, it has been observed feeding on residential lawns, orchards, and intertidal habitats in coastal areas (Cannings 1995; Campbell et al. 1997).

## **Conservation and Management**

### **Status**

The Sage Thrasher is on the provincial *Red list* in British Columbia. It is designated as *Endangered* in Canada (COSEWIC 2002). (See Summary of ABI status in BC and adjacent jurisdictions at top of next page.)

### **Trends**

#### **Population trends**

In British Columbia, Sage Thrasher populations have fluctuated over the last 100 years (Cannings et al. 1987). Before 1914, several pairs were present at White Lake, whereas in the 1920s, it appeared to be absent from that location (Cannings et al. 1987). During 1931, an estimated 15 pairs were present at White Lake (Darcus 1932). The highest count at

Summary of ABI status in BC and adjacent jurisdictions (NatureServe Explorer 2002)

AB	BC	CA	ID	MT	OR	WA	Canada	Global
S1B	S1B	S5	S5B, S2N	S5B, S2N	S4	S3B, S2N	N1B	G5

White Lake in the past 35 years was five pairs in 1969; they have averaged one to two pairs since then (Cannings et al. 1987). At Chopaka, an estimated 6–10 pairs nest annually, and several pairs are thought to nest south of Kilpoola Lake (Campbell et al. 1997; Cannings 2000). In 1990, the Chopaka, Richter Pass, Kilpoola Lake, and White Lake areas were thoroughly searched for 6 days but only four birds were found (Preston 1990). In 1991, the same area was searched and 11 Sage Thrashers were found singing (Cannings 2000). In 1993, single active nests were found at Kilpoola and Chopaka and seven adults were censused (R. Millikin, pers. comm.). In 1994, no active nests were located after extensive surveys and only four adults were censused. At its historical high, the British Columbia population of Sage Thrashers may have been as high as 30 or more pairs (Cannings 2000).

Sage Thrasher populations appear to be stable across their range. Regional significant population increases (between 1966 and 1999) have been noted in California (3.4%) on Breeding Bird Surveys (Sauer et al. 2000). Populations appear to be increasing in Colorado and Oregon (Sauer et al. 2000). Peripheral populations in Washington are on the decline because of large-scale habitat losses (Reynolds et al. 1999). Why Sage Thrashers are doing well in areas where other sagebrush obligates such as Sage Grouse (*Centrocercus urophasianus*) and Brewer’s Sparrow (*Spizella breweri*) are declining is not known, but Sage Thrashers may tolerate habitat fragmentation better than other species (Knick and Rotenberry 1995b). In one area where sagebrush was sprayed and shrub cover was reduced from 28 to 4% and grass cover increased, Sage Thrashers declined only slightly in the short term (Weins and Rotenberry 1985).

**Habitat trends**

The area of suitable habitat available in British Columbia has slowly been declining over the past 70 years. In all, there has probably been <50% of habitat lost in the past 70 years, but development pressures on remaining highly suitable habitat, particularly in the Richter Pass and White Lake areas, are very high (Cannings 1995). Of the 27 478 ha of suitable habitat (much of which is suboptimal) in the south Okanagan and Similkameen valleys, 42% is private land, 28% Indian Reserve, 26% provincial Crown land, and 4% conservation lands (MELP 1998). Vineyard developments on the Inkameep Indian Reserve (Osoyoos Indian Reserve) have destroyed several hundred hectares of shrub-steppe habitat on the east side of Osoyoos Lake. This area is probably not optimal for Sage Thrasher since it is a mix of antelope-brush, big sagebrush (*Artemisia tridentata*), and rabbitbrush (*Ericameria nauseosus*), but thrashers have nested there in the past (Cannings 2000). Further agricultural, housing, and tourism developments threaten several more hundred acres of habitat in the reserve, although about 500 ha is proposed for protection. Urbanization and other developments are also impacting lowland habitats in other areas. Range improvement programs attempting to eradicate sagebrush through burning or mowing are impacting habitat quality in some areas.

Loss of suitable habitat in Washington State is of concern to Canadian populations. Approximately half of the historic area of sagebrush steppe in the United States has been lost to intensive agriculture, and only half of the remaining portion is in good condition (Vander Haegen et al. 1999; Cannings 2000).

## Threats

### Population threats

Small breeding population with a restricted distribution and unsecured habitat (Fraser et al. 1999).

Pesticide spraying may impact some populations. In the United States, local declines of grassland birds have been potentially linked to grasshopper control programs using pesticides (Paige and Ritter 1999). In shrub-steppe habitats in southern Idaho, Howe et al. (1996) found that malathion application had no observable direct effects, and only marginal indirect effects, through food-base reduction, on Brewer's Sparrow and Sage Thrasher nestling growth and survival. George et al. (1995) noted that pesticide treatments for grasshopper control had little effect on breeding bird communities in western rangelands.

Eggs and young are lost as a result of large mammalian predators, snakes, birds, and small mammals (Rotenberry and Wiens 1989; Reynolds et al. 1999). Rotenberry and Wiens (1989) considered Gopher Snakes (*Pituophis melanoleucus*) to be the principal predator of shrub-steppe breeding birds in the northern Great Basin.

### Habitat threats

The primary limiting factor for Sage Thrasher in Canada is the loss, alteration, or degradation of sagebrush habitats. Loss of sagebrush habitat to agriculture, strip mining, and residential development in the United States (Braun et al. 1976), conversion to wheatfields in Washington State (Weber 1980), and agricultural development of dryland farming areas in Alberta (Cannings 2000) has caused great concern for Sage Thrasher using these environments. Complete replacement of native sagebrush habitat with crested wheatgrass (*Agropyron cristatum*) eliminates this species (Reynolds and Trost 1980, 1981). Even removal of only large sagebrush in breeding habitats can limit utilization by thrashers (Castrale 1982). Generally, land development activities that reduce sagebrush cover below 10% over large areas likely negatively affect Sage Thrashers (Braun et al. 1976).

Continued loss of sagebrush-steppe habitats in British Columbia is the primary threat to Sage Thrasher populations. Urbanization and development, particularly the rapid expansion of vineyards in the south Okanagan, housing developments in the Richter Pass area (Preston 1990), and sagebrush removal for improving range, are the greatest threats to sagebrush habitats. Heavy grazing pressure may affect Sage Thrasher populations negatively (Bradford et al. 1998), but thrashers are generally less sensitive to grazing pressure than other shrub-steppe bird species (Reynolds and Trost 1981; Kantrud and Kologiski 1982). Saab et al. (1995) reported several studies where heavy grazing resulted in a positive response in Sage Thrasher abundance. Historically, intensive range management programs, such as burning, mowing, herbiciding, and planting with crested wheatgrass, negatively impacted sagebrush habitats and the birds using these areas (Reynolds and Trost 1981; Wiens and Rotenberry 1985; Knick and Rotenberry 2000).

Fires may pose a threat to Sage Thrasher in terms of habitat loss, since sagebrush does not resprout after being burned (Castrale 1982). Kerley and Anderson (1995) found that burned areas still lacked thrashers 9 years after a fire, and herbicided areas still had suppressed thrasher populations 22 years after treatment. Petersen and Best (1987) found that Sage Thrasher abundance was unaffected by prescribed burning which resulted in a mosaic of burned and unburned areas in southeastern Idaho. The spread of cheatgrass (*Bromus tectorum*) has had a negative effect on Sage Thrasher populations through its influence on fire regimes in western grasslands (Knick and Rotenberry 1997). Cheatgrass, an annual species, tends to occur in large monocultures that are highly flammable, increasing the spread of fire and loss of sagebrush and other shrubs and accelerating the spread of annuals such as cheatgrass (Paige and Ritter 1999).

Potential effects of grazing include trampling of sagebrush plants by livestock.

## Legal Protection and Habitat Conservation

The Sage Thrasher, its nests, and its eggs are protected in Canada under the federal *Migratory Birds Convention Act*, and in British Columbia, by the provincial *Wildlife Act*.

According to MELP (1998), only 4% (i.e., 1263 ha) of potential Sage Thrasher habitat is currently designated as conservation lands. Protected areas in the south Okanagan include the Nature Trust of British Columbia lands at White Lake. A number of new protected areas have been announced in the south Okanagan through the Okanagan-Shuswap Land and Resource Management Plan process. Some of the more important proposed parks for Sage Thrasher include White Lake Grasslands and South Okanagan Grasslands. Riparian and biodiversity guidelines under the results based code provide some protection of habitat for Sage Thrasher.

## Identified Wildlife Provisions

### Strategic management recommendations

- ❖ Protection of large areas of continuous sagebrush-steppe habitats is the most important approach required for recovery. Increasing the health of sagebrush-dominated rangelands, and providing suitable nesting habitat is essential in maintaining and increasing populations of Sage Thrasher in British Columbia. Protecting and enhancing these habitats will also benefit other sagebrush-obligate species such as the Sagebrush Brewer's Sparrow and Great Basin Pocket Mouse, and will address overall biodiversity objectives for the region.
- ❖ Since population trends of Sage Thrasher in Washington State will likely be reflected in trends in the Canadian population, recovery plans must be co-ordinated with recovery teams or responsible agencies in Washington State.
- ❖ Incorporate WHAs for the Sage Thrasher into grassland networks managed to maintain natural grassland communities. Adjacent wetlands and moist gullies, and a substantial proportion of remaining late-seral sagebrush communities should also be included in grassland networks.

## Wildlife habitat area

### Goals

Maintain suitable nesting habitat for multiple pairs.

### Feature

Establish WHAs in areas with breeding densities of one or more pairs and selected high suitability historic breeding sites.

### Size

Typically between 10 to 100 ha of shrub-steppe habitats, or up to 200 ha of discontinuous habitat.

### Design

A WHA should include sagebrush-dominated shrub-steppe habitats with a mosaic of habitat attributes including a low amount of bare ground (10–20%), moderate densities of shrubs (10–30%), and clumps of big sage (2–10 shrubs >1 m in height).

## General wildlife measures

### Goals

1. Maintain the integrity of nesting habitat by retaining density and structure of sagebrush habitat.
2. Minimize fires and other activities that remove 100% shrub cover.

### Measures

#### Access

- Do not construct roads unless there is no other practicable option.

#### Pesticides

- Do not use pesticides.

#### Range

- Plan livestock grazing to minimize crown breakage, maintain the desired sagebrush cover.
- Protect large sagebrush patches during weed control programs.
- Maintain clumps of large (>0.9 m in height and >1.1 m in width) living sagebrush.
- Do not place livestock attractants within WHA.

## Additional Management Considerations

Maintain low-elevation, dry shrub-steppe. Avoid widespread range burning and clearing of native shrubs such as sagebrush and antelope-brush in important breeding areas.

Avoid high intensity grazing that negatively impacts shrubs and reduces shrub cover required by Sage Thrashers.

Implement protection measures to reduce the risk of fire which eliminates 100% of shrubs.

Prevent invasion of cheatgrass into intact shrub-steppe habitats.

Minimize further removal of sagebrush for residential, commercial, and agricultural development. Re-establish sagebrush communities where possible.

## Information Needs

1. Foraging behaviour and the impact of cattle grazing on availability of insect prey and shrubs used for nesting.
2. Habitat attributes of nest sites and breeding territory.
3. The impact of tree encroachment in sagebrush-steppe habitats on habitat availability for Sage Thrasher.

## Cross References

“Great Basin” Gopher Snake, Racer, “Sagebrush” Brewer’s Sparrow

Requirements of the Long-billed Curlew and Grasshopper Sparrow may conflict with management prescriptions for Sage Thrasher. The Long-billed Curlew requires more open grassland, the Grasshopper Sparrow requires grassland with few or no shrubs.

## References Cited

Bent, A.C. 1948. Life histories of North American nuthatches, wrens, thrashers and their allies. U.S. Natl. Mus. Bull. 195.

Blood, D.A. 1995. Wildlife in British Columbia at risk: Sage Thrasher. B.C. Min. Environ., Lands and Parks, Wildl. Br., Victoria, B.C.

Bradford, D.F., S.E. Franson, A.C. Neale, D.T. Heggem, G.R. Miller, and G.E. Canterbury. 1998. Bird species assemblages as indicators of biological integrity in Great Basin rangeland. Environ. Monit. Assessment 49:1–22.

Braun, C.E., M.F. Baker, R.L. Eng, J.S. Gashwiller, and M.H. Schroeder. 1976. Conservation Committee Report on effects of alteration of sagebrush communities on the associated avifauna. Wilson Bull. 88(1):165–171.

B.C. Ministry of Environment, Lands and Parks (MELP). 1998. Habitat atlas for wildlife at risk: South Okanagan & Lower Similkameen. Penticton, B.C.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, M.C.E. McNall, and G.E.J. Smith. 1997. The birds of British Columbia. Vol. III: Passerines. Flycatchers through vireos. B.C. Min. Environ., Lands and Parks, Victoria, B.C., and Can. Wildl. Serv., Delta, B.C.

Cannings, R.A., R.J. Cannings, and S.G. Cannings. 1987. Birds of the Okanagan Valley, British Columbia. Royal B.C. Mus., Victoria, B.C.

Cannings, R.J. 1995. Status of the Sage Thrasher in British Columbia. B.C. Min. Environ., Lands and Parks, Victoria, B.C. Wildl. Bull. B-79.

\_\_\_\_\_. 1998. The birds of British Columbia: a taxonomic catalogue. B.C. Min. Environ., Lands and Parks, Wildl. Br. and Resour. Inventory Br., Victoria, B.C. Wildl. Bull. B-86. 243 p.

\_\_\_\_\_. 2000. Update COSEWIC status report on Sage Thrasher (*Oreoscoptes montanus*). Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ont.

Castrale, J.S. 1982. Effects of two sagebrush control methods on nongame birds. J. Wildl. Manage. 46:945–952.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002. Canadian Species at Risk. [www.speciesatrisk.gc.ca](http://www.speciesatrisk.gc.ca)

Darcus, S.J. 1932. The present status of the Sage Thrasher in British Columbia. Murrelet 13:22.

Dobkin, D.S. 1992. Neotropical migrant landbirds in the Northern Rockies and the Great Plains. U.S. Dep. Agric. For. Serv., Missoula, Mont. Northern Reg. Publ. R1-93-34. 144 p.



- Dobler, F.C., J. Eby, S. Richardson, and M. Vander Haegen. 1996. Shrub-steppe research project: extent, ownership, and wildlife/vegetation relationships. Wash. Dep. Fish Wildl., Wildl. Manage. Program, Olympia, Wash.
- Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The birder's handbook: a field guide to the natural history of North American birds. Simon & Schuster Inc., Toronto, Ont.
- Fraser, D.F., W.L. Harper, S.G. Cannings, and J.M. Cooper. 1999. Rare birds of British Columbia. B.C. Min. Environ., Lands and Parks, Wildl. Br. and Resour. Inventory Br., Victoria, B.C. 244 p.
- Friedmann, H. and L.F. Kiff. 1985. The parasitic cowbirds and their hosts. Proc. West. Found. Vertebr. Zool. 2:226–303.
- George, L.T., L.C. McEwen, and B.E. Petersen. 1995. Effects of grasshopper control programs on rangeland breeding bird populations. J. Range Manage. 48:336–342.
- Godfrey, W.E. 1986. The birds of Canada. Natl. Mus. Nat. Sci., Ottawa, Ont. 595 p.
- Gooding, J.W. 1970. Breeding biology of the Sage Thrasher. M.S. thesis. Cent. Wash. State Coll., Ellensburg, Wash.
- Howe, F.P., R.L. Knight, L.C. McEwen, and T.L. George. 1996. Direct and indirect effects of insecticide applications on growth and survival of nestling passerines. Ecol. Appl. 6(4):1314–1324.
- Howell, S.N.G. and S. Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford Univ. Press, New York, N.Y.
- Kantrud, H.A. and R.L. Kologiski. 1982. Effects of soil and grazing on breeding birds of uncultivated upland grasslands of the northern Great Plains. U.S. Dep. Agric. Fish Wildl. Serv., Washington, D.C. Wildl. Res. Rep. 15.
- Kerley, L.L. and S.H. Anderson. 1995. Songbird responses to sagebrush removal in a high elevation sagebrush steppe ecosystem. Prairie Natur. 27:129–146.
- Knick, S.T. and J.T. Rotenberry. 1995a. Habitat relationships and breeding birds on the Snake River Birds of Prey area. Idaho Bur. Land Manage. Tech. Bull. 95-5.
- \_\_\_\_\_. 1995b. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conserv. Biol. 9:1059–1071.
- \_\_\_\_\_. 1997. Landscape characteristics of disturbed shrubsteppe habitats in southwestern Idaho. Landscape Ecol. 12:287–297.
- \_\_\_\_\_. 2000. Ghosts of habitats past: contribution of landscape change to current habitats used by shrubland birds. Ecology 81:220–227.
- McAdoo, J.K., W.S. Longland, and R.A. Evans. 1989. Nongame bird community responses to sagebrush invasion of crested wheatgrass seedlings. J. Wildl. Manage. 53(2):494–502.
- Medin, D.E. 1992. Birds of a Great Basin sagebrush habitat in west-central Nevada. U.S. Dep. Agric. For. Serv., Res. Pap. INT-452.
- Millikin, R.L. 1996. Update on the Sage Thrasher *Oreoscoptes montanus* in the South Okanagan. Report prepared for B.C. Min. Environ., Lands and Parks, Wildl. Br., Penticton, B.C. Unpubl.
- National Geographic Society (NGS). 1999. Field guide to birds of North America. Washington, D.C.
- NatureServe Explorer. 2002. An online encyclopaedia of life. Version 1.6. NatureServe. Arlington, VA. Available at <http://www.natureserve.org/explorer/>
- Nelson, K. 1993. Investigations into habitat needs of the Sage Thrasher *Oreoscoptes montanus* in the South Okanagan. Report prepared for the Okanagan Region Wildl. Heritage Fund Soc., B.C. Min. Environ., and Can. Wildl. Serv. Unpubl.
- Paige, C. and S.A. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group, Boise, Idaho.
- Petersen, K.L. and L.B. Best. 1987. Effects of prescribed burning on nongame birds in a sagebrush community. Wildl. Soc. Bull. 15:317–329.
- \_\_\_\_\_. 1991. Nest-site selection by Sage Thrashers in southeastern Idaho. Great Basin Nat. 51(3):261–266.
- Preston, A. 1990. Canyon Wren, Sage Thrasher, White-headed Woodpecker, Gray Flycatcher and Grasshopper Sparrows in the South Okanagan. Field report prepared for B.C. Min. Environ., Penticton, B.C. Unpubl.
- Reynolds, T.D. 1981. Nesting of the Sage Thrasher, Sage Sparrow, and Brewer's Sparrow in southeastern Idaho. Condor 83:61–64.
- Reynolds, T.D. and T.D. Rich. 1978. Reproductive ecology of the Sage Thrasher (*Oreoscoptes montanus*) on the Snake River Plain in south-central Idaho. Auk 95:580–582.
- Reynolds, T.D. and C.H. Trost. 1980. The responses of native vertebrate populations to crested wheatgrass planting and grazing by sheep. J. Range Manage. 33(2):122–125.

- \_\_\_\_\_. 1981. Grazing, crested wheatgrass and bird populations in southeastern Idaho. *Northwest Sci.* 55(3):225–234.
- Reynolds, T.D., T.D. Rich, and D.A. Stephens. 1999. Sage Thrasher (*Oreoscoptes montanus*). In *The birds of North America*, No. 463. A. Poole and F. Gill, eds. The Birds of North America, Inc., Philadelphia, Penn.
- Rich, T. 1980. Nest placement in Sage Thrashers, Sage Sparrows, and Brewer's Sparrows. 1980. *Wilson Bull.* 92(3):362–368.
- Rich, T.D. and S.I. Rothstein. 1985. Sage Thrashers reject cowbird eggs. *Condor* 87:561–562.
- Rich, T.D.G. 1978. Nest placement in Sage Thrasher. *Wilson Bull.* 90(2):303.
- Rotenberry, J.T. and J.A. Weins. 1989. Reproductive biology of shrubsteppe passerine birds: geographical and temporal variation in clutch size, brood size, and fledgling success. *Condor* 91:1–14.
- Saab, V.A., C.E. Bock, T.D. Rich, and D.S. Dobkin. 1995. Livestock grazing effects in western North America. In *Ecology and management of neotropical migratory birds*. T.E. Merten and D.M. Finch (editors). Oxford Univ. Press, New York, N.Y., pp. 311–353.
- Sauer, J.R., J.E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, results and analysis 1966–1999*. Version 98.1, U.S. Geol. Surv., Patuxent Wildl. Res. Cent., Laurel, Md.
- Stephens, D.A. 1985. Foraging ecology of shrubsteppe birds in central Washington. M.Sc. thesis. Central Wash. Univ.
- Vander Haegen, W.M., F.C. Dobler, and D.J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in Eastern Washington, USA. *Conserv. Biol.* 14(4):1145–1160.
- Weber, W.C. 1980. A proposed list of rare and endangered species for British Columbia. In *Threatened and endangered species and habitats in British Columbia and the Yukon*. R. Stace-Smith, L. Johns, and P. Joslin (editors). B.C. Min. Environ., Fish Wildl. Br., Victoria, B.C., pp. 160–182.
- Weins, J.A. and J.T. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. *Ecol. Monogr.* 51(1):21–41.
- \_\_\_\_\_. 1985. Response of breeding passerine birds to rangeland alteration in a North American shrubsteppe locality. *J. Appl. Ecol.* 22:655–668.

## Personal Communications

- Millikin, R. 2002. Can. Wildl. Serv., Delta, B.C.