NORTHERN HARRIER
Circus cyaneus

Description

Harriers in North America belong to the subspecies *Circus cyaneus hudsonius*, and are larger than the hen harriers of Eurasia (*C. c. cyaneus*) and the Cinnereous harriers of South America (*C. c. cinereus*) (MacWhirter and Bildstein 1996).

The northern harrier, also known as the marsh hawk, is a slim, medium-sized raptor, whose distinct facial ruff gives it an owl-like appearance and facilitates auditory detection of prey (MacWhirter and Bildstein 1996). Its prominent white rump and characteristic low, coursing flight make it easy to distinguish the northern harrier from other raptors in the field.

The degree of sexual dimorphism in northern harriers is unique among North American raptors. Adult female plumage is dark brown above and buff below, with some streaking on the underparts. The tail is barred. The male plumage is pale gray above and white below with reddish spots on the underparts. The wingtips are edged with black. Younger males have brown dorsal markings. Adult females are heavier and have a larger wingspan than males. The mean weight of the adult female is about 530 g and her wingspan ranges from 110 to 137 cm. The mean weight of the adult male is about 370 g, and his wingspan varies from 102 to 114 cm (data synthesis by MacWhirter and Bildstein 1996).

Life history & behavior

A ground-nesting raptor that forages on the wing for its prey.

Based on limited data reviewed by MacWhirter and Bildstein (1996), fidelity to natal sites and breeding territories is moderate; some degree of fidelity to winter home range may occur.

During its low, coursing, hunting flight over grasslands, crops, marshes, and shrublands, the northern harrier uses auditory and visual cues to locate its prey, which includes small mammals (primarily rodents), reptiles, amphibians, birds, and occasionally, large insects (Ryser 1985).

Northern harriers are monogamous or polygynous, with some males pairing with several mates in a season. The frequency of polygyny may increase with prey abundance. Locally, nesting numbers and reproductive success are probably strongly affected by prey abundance, but predation, nest-site quality, rate of male food-provisioning, date of egg-laying, and weather may also be important factors. Northern harriers produce one brood per year, but may re-nest after unsuccessful attempts (MacWhirter and Bildstein 1996; MacWhirter and Bildstein 1996 citing others).

Northern harriers nest on the ground, typically in tall, dense ground cover. Mean clutch size is 4.4 eggs. Females incubate eggs and brood offspring, while males provision for their mates and nestlings. Number of offspring fledged per successful nest averaged 3.1 in studies reviewed by MacWhirter and Bildstein (1996). Adults arrive on the breeding grounds between late March and early April, and begin spectacular courtship flights. They depart for their winter range between August and November. In winter, northern harriers may roost communally on the ground.

Population trends

Potentially in decline rangewide; BBS trend data are mixed.

Like many raptors, the northern harrier probably suffered historic declines due to widespread use of DDT.

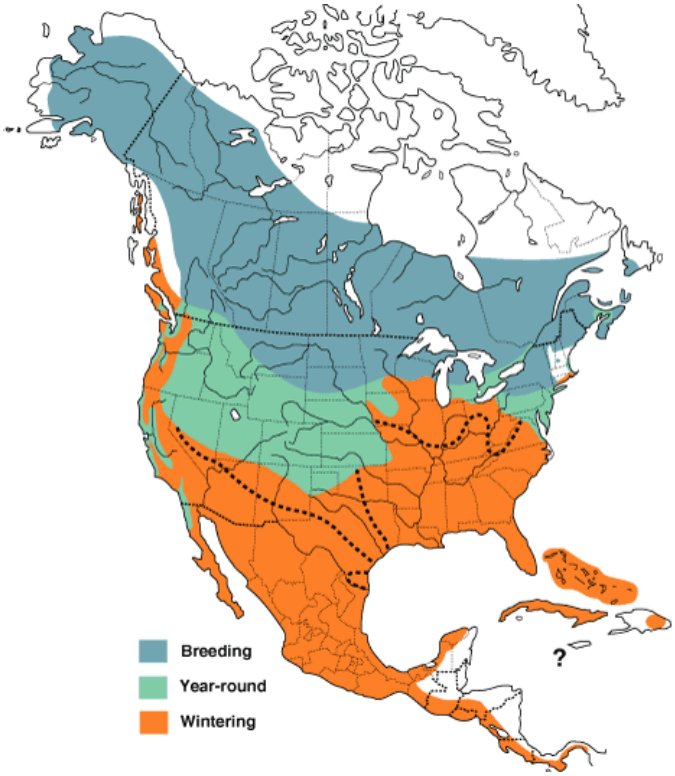
Standard BBS trend estimates (Sauer et al. 2004) show a pattern of long-term northern harrier declines across its range, although the species may be poorly sampled by BBS methods due to low relative abundances. Selected annual average BBS trend estimates for the period of 1966 through 2003 are as follows:

- 1.0% survey-wide (*P*=0.02, n=1,024, RA=0.45)
+ 0.7% in eastern region (*P*=0.39, n=302, RA=0.12)
- 1.5% in western region (*P*<0.01, n=407, RA=0.54)
- 1.7% in Colorado (*P*=0.54, n=39, RA=0.34)

In Colorado, northern harrier population trends are not tracked by MCB (Leukering and Levad 2002).

Range

The northern harrier remains extant in all states in which it historically occurred. Its local distribution throughout the eastern U.S. and Canada during European settlement likely expanded as forests were converted to croplands. Since the 1940s, northern harrier distribution has likely shifted in response net loss of wetlands, croplands, and undisturbed grasslands (MacWhirter and Bildstein 1996).



Northern harrier range in North America. Breeds locally south of dotted line. Map reprinted from MacWhirter and Bildstein (1998) by permission.

The northern harrier is widely but locally distributed in North America. It is absent or a rare breeder in many northeastern states and in mountainous or desert regions of the west coast. Breeding birds are most abundant on the Northern Great Plains, the northern Great Basin, and the Columbia Plateau (Sauer et al. 2004). Centers of abundance for wintering northern harriers are the Great Basin and the southern Great Plains (MacWhirter and Bildstein 1996).

Colorado distribution patterns & abundance

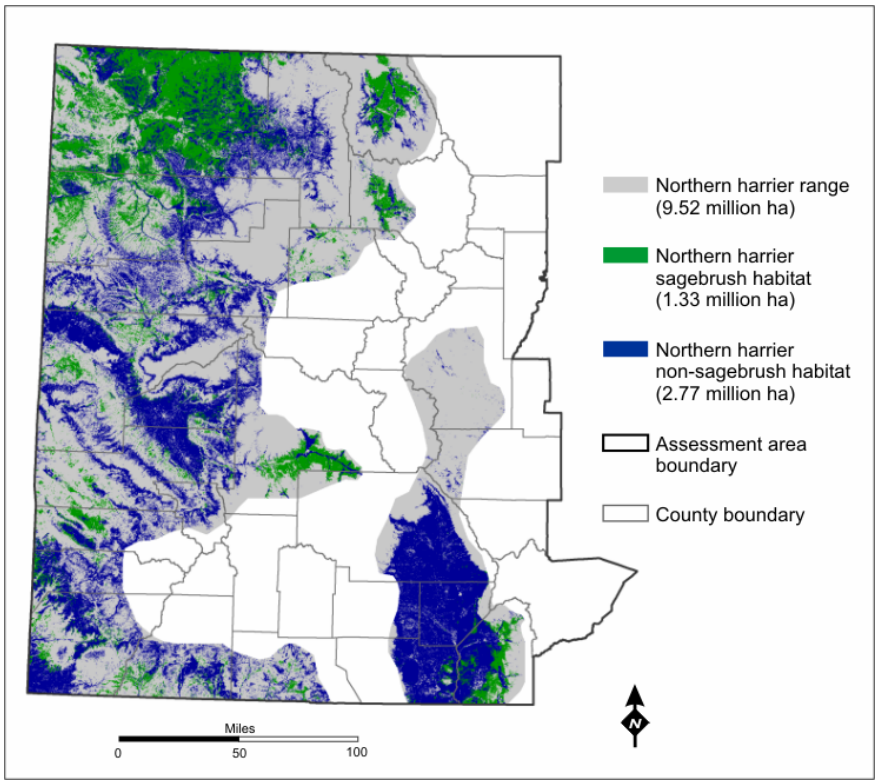
In Colorado, northern harriers typically nest up to 9,500 feet (Andrews and Righter 1992); they are most common from 6,000 to 8,000 feet (Righter et al. 2004).

Northern harrier range in the assessment area encompasses approximately 9.52 million ha, with about 4.10 million ha of suitable habitat.

Andrews and Righter (1992) noted that northern harriers in Colorado are least numerous in summer and most numerous during migrations.

MCB methodology cannot reliably estimate breeding densities of this species (Leukering and Levad 2002).

The Colorado BBA estimated that 2,179 breeding pairs of northern harriers occur in the state; just over half (57 percent) of these are on the eastern plains, with the remainder in central and western Colorado (Carter 1998). In the assessment area, centers of breeding bird abundance are the northwest counties, the San Luis Valley, and Montezuma County. Breeding northern harriers are mostly absent from the mountains, although they have been reported occasionally in mountain parks on Grand Mesa and the Flat Tops (Andrews and Righter 1992; Carter 1998; Righter et al. 2004).



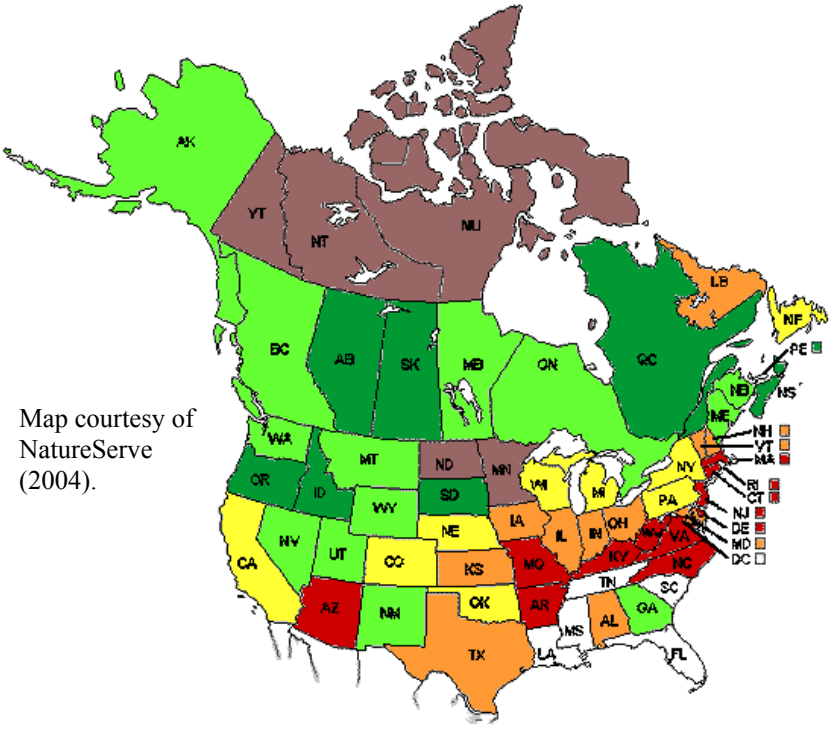
Migrating northern harriers are uncommon to fairly common in Colorado's western valleys, mountain parks, and eastern plains, and occasional in the mountains above timberline. During winter, resident northern harriers are uncommon to fairly common on the eastern plains, in the western valleys, and in the San Luis Valley (Andrews and Righter 1992).

Breeding densities in occupied habitat are highly variable. The Colorado BBA project recorded no more than 10 pairs of breeding birds in any survey block (Carter 1998). In southwest Idaho sagebrush shrubsteppe, densities were less than 0.02 individuals per 10 km^2 (Martin 1987). Literature reviewed by MacWhirter and Bildstein (1996) for northern harriers nesting in croplands, wetlands, and grasslands reported densities ranging from 0.8 to 19.5 birds per 10 km^2. Densities of wintering birds in Colorado are unknown.

Conservation status

Ranked G5/S3, "demonstrably secure" rangewide and "vulnerable" in Colorado (NatureServe 2004). CNHP does not track the northern harrier (CNHP 2004).

A Forest Service Region 2 sensitive species.



Map courtesy of NatureServe (2004).

The northern harrier is listed as endangered in Illinois, Iowa, Indiana, Missouri, New Jersey, Connecticut, and Rhode Island, and listed as threatened in Tennessee, New Hampshire, Massachusetts, and New York. Michigan, Wisconsin, and Vermont recognize the northern harrier as a species of concern.

Habitat

In the Colorado sagebrush assessment area, about 4.40 million ha of suitable habitat exists, 1.33 million ha of which is sagebrush shrublands (see figure in Colorado Distribution Patterns and Abundance).

Northern harriers typically nest and hunt in relatively open, treeless country, including wet or dry grasslands, emergent graminoid wetlands, lightly grazed pastures, croplands, fallow fields, and shrublands (MacWhirter and Bildstein 1996).

About 72 percent of breeding northern harrier occurrences recorded by the Colorado BBA project were in croplands, grasslands, emergent wetlands, or lowland riparian areas (Carter 1998). About 13 percent of the occurrences were in sagebrush. The breakdown of Colorado BBA occurrences is as follows:

28% - croplands
26% - grassland types, combined
18% - emergent wetlands & lowland riparian
13% - sagebrush
9% - mountain shrub, tall semi-desert shrubland, and montane willow carr, combined
4% - montane woodland

Northern harrier nest sites are generally characterized by tall, dense live and residual grasses and forbs or low shrubs. In the northern Great Plains, 52 percent of 27 nests were in grasses and forbs taller than 60 cm. Litter cover

was greater than 12 percent, and areas with greater than 40 percent residual cover were more commonly used. In northwestern North Dakota, nests were in 0.05 to 0.5 ha stands of western snowberry or other shrub species with forb and grass understories. Harrier nests in southwestern Missouri were found almost exclusively in blackberry patches with a mean size of 98 square meters (synthesis by MacWhirter and Bildstein 1996). No data are available regarding physiognomic parameters of nest sites in sagebrush shrublands.

Minimum area requirements for the northern harrier are uncertain, and may be dependent on landscape context of suitable habitat and prey availability.

Northern harriers hunt over country similar to preferred nesting areas. In arid southwestern Idaho, northern harriers foraged heavily over sagebrush shrubsteppe after nearby alfalfa fields reached a height of 46 cm (Martin 1987).

During winter and migrations, northern harriers generally use the same habitat types they use during summer, with a few exceptions. During fall in Colorado, northern harriers may occur above timberline on alpine tundra (Andrews and Righter 1992).

Average territory size for breeding birds varies considerably among sites (170 to 15,000 ha, median 260 ha, n = 8 non-sagebrush shrubland habitat types), presumably owing to differences in food supply and habitat structure (synthesis by MacWhirter and Bildstein 1996). Typically, females forage closer to the nest than males, and their home ranges are usually smaller than those of males. In Idaho sagebrush shrubsteppe, home ranges averaged 1,570 ha for males and 113 ha for females (Martin 1987). Males will hunt up to 10 km from the nest, in ranges overlapping those of other males. Both genders increase their home ranges significantly as the nestling period progresses.

Minimum area requirements for the northern harrier are uncertain. Studies in Conservation Reserve Program fields in North Dakota found that northern harriers were uncommon in patches of grassland less than 100 ha (D. H. Johnson, unpublished data cited in Dechant et al. 1999a). In Illinois, northern harriers nested in grassland fragments ranging from 8 to 120 ha; and five of 29 nests were in grassland tracts less than 45 ha (Duebbert and Lokemoen 1977), suggesting that small habitat fragments may be used if larger patches of suitable habitat are nearby.

Threats & sensitivities

The greatest threats to northern harrier populations have probably been loss of appropriate wetland habitats rangewide, and loss of farmlands in the eastern U.S. to forest reversions or residential development (Carter 1998). Historically, DDT probably also affected nest success (Carter 1998).

In western Colorado, where sagebrush makes up about 32 percent of northern harrier suitable habitat, threats to sagebrush are a significant concern.

In western Colorado, where sagebrush makes up about 32 percent of northern harrier suitable habitat, loss and degradation of sagebrush are significant concerns. Northern harrier sagebrush habitat in Colorado is at risk of four widespread threats modeled in the Colorado sagebrush conservation assessment and strategy: pinyon-juniper encroachment, encroachment by invasive herbaceous plants, residential development, and energy development.

See Chapter 6 for more detail about estimates and predictive threats modeling for northern harrier sagebrush habitat

Residential development probably poses the lowest threat of the four, with an estimated 1 percent of northern harrier sagebrush habitat at high risk, 2 percent at moderate risk, and 13 percent at low risk. About 83 percent of northern harrier sagebrush habitat is at no risk of residential development based on our predictive model. Residential development threats to sagebrush are fairly scattered, with hot spots for northern harrier sagebrush habitat around Craig, Cortez, and Mancos.

Risk of pinyon-juniper encroachment in northern harrier sagebrush habitat is

in the Colorado assessment area. Chapter 4 presents rule sets for threats modeling in sagebrush habitat.

moderate to high, and fairly widespread throughout northern harrier range. Our predictive model estimated 30 percent of northern harrier sagebrush habitat is at high risk of pinyon-juniper encroachment, while 28 percent is at moderate risk, and 42 percent is at low risk. Less than 1 percent of northern harrier sagebrush habitat is at no risk of pinyon-juniper encroachment.

Risk of energy development is broadly moderate. About 70 percent of northern harrier sagebrush habitat is at moderate risk of energy development in the Colorado sagebrush assessment area, 19 percent is at low or no risk, and 10 percent is at high risk. Energy development can result in destruction, degradation, and fragmentation of habitat via mechanisms described in Chapter 2. Sagebrush habitat at highest risk of energy development is scattered throughout the western-most counties in the assessment area, with larger hot spots clustered in Rio Blanco, Garfield, and southern La Plata Counties. The effects of habitat fragmentation on the northern harrier are unknown. Large tracts of undisturbed suitable habitats or mosaics of habitats typically support the highest densities of northern harriers (MacWhirter and Bildstein 1996).

Over 99 percent of northern harrier sagebrush habitat is at some degree of risk of encroachment by invasive herbaceous plants. Our model predicts 30 percent at high risk, 28 percent at moderate risk, and 42 percent at low risk. The effects of invasive herbaceous encroachment on northern harrier sagebrush habitat quality have not been studied, but are likely adverse where conditions for prey populations become unfavorable. Sagebrush habitat at moderate or high risk of encroachment in northern harrier range is mostly broadly scattered across the western-most counties at lower elevations. Moffat and Rio Blanco Counties contain the largest contiguous patches of sagebrush habitat at high risk of encroachment by invasive herbaceous plants.

There are no long-term, comprehensive studies comparing avifaunas of ungrazed and grazed sagebrush shrubsteppe habitats in Colorado or elsewhere, but two comprehensive literature reviews (Bock et al. 1993; Saab et al. 1995) tentatively concluded the overall effects of grazing on northern harriers in sagebrush shrublands are adverse, based on their preference, and the preference of their prey, for relatively dense forb and grass cover. Northern harriers do not use heavily grazed grassland habitats, but may use lightly to moderately grazed grasslands (Bock et al. 1993; Kantrud and Kologiski 1983). Livestock can also directly affect nest success by trampling nest sites. The effects of chemical and mechanical sagebrush treatment to improve range conditions for cattle are unknown, but are likely low, especially where ground cover and litter are increased. Range treatments could have adverse indirect effects where prey species densities are diminished or shrubsteppe vegetation cover and density is reduced.

Croplands with favorable height, density, frequency of harvest, and prey abundance are important forage sites rangewide, but could function on the local level as environmental sinks when selected as nesting habitat. Nest success may be lower in cropland and fallow fields than in undisturbed areas (Dechant et al. 1999).

Northern harrier eggs and nestlings are preyed upon by coyote, feral dogs, striped skunks, raccoons, and red fox. Crows and ravens destroy eggs, and great horned owls take nestlings and fledglings (MacWhirter and Bildstein

1996). Northern harriers avoid areas of heavy human use, but are somewhat tolerant of observation blinds near their nests. Shooting has been and remains a problem in some parts of their range (MacWhirter and Bildstein 1996).

Research needs

Currently, the status of both breeding and wintering populations of northern harriers in western Colorado is unknown due to of the lack of reliable estimates of their abundance. Standardized survey methods are needed to determine population trends on a regional level. Regional variations in nesting habitat and prey availability as factors limiting nesting densities have not been examined.

Population trend monitoring should be coupled with investigation of nest success and prey availability under alternate rangeland management and grazing regimes, over a spectrum of habitat conditions and geographic areas in Colorado.

Information is needed regarding landscape-scale patterns of habitat use, effects of habitat fragmentation, and patch size and habitat connectivity requirements of the northern harrier, so that effective management can be implemented.

Management issues

About 59 percent of northern harrier sagebrush habitat in the Colorado sagebrush assessment area is on public lands, and almost 85 percent of those public lands are managed by BLM. BLM is the public entity best-positioned to have a positive impact on the northern harrier in its sagebrush shrubland habitat.

Management of a complex of several different habitat types, including shrublands, grasslands (upland and wetland), and marshes may benefit breeding harriers (Dechant et al. 1999; Serrentino et al. 1992).

Our threats analysis did not consider non-sagebrush vegetation types, which provide a significant amount (about 68 percent) of the northern harrier's habitat in the assessment area. Ideally, conservation planning and management of species of concern should consider all significant habitat types for a species of concern. Such an approach was beyond the scope of this assessment.

Literature Cited

Andrews, R. and R. Righter. 1992. *Colorado birds: a reference to their distribution and habitat*. Denver: Denver Museum of Natural History.

Bock, C. E., V. A. Saab, T. D. Rich, and D. S. Dobkin. 1993. Effects of livestock grazing on neotropical migratory landbirds in western North America. In *Status and management of neotropical migratory birds*, edited by D. M. Finch and P. W. Stangel: USDA Forest Service, General Technical Report RM-229.

Carter, M. F. 1998. Northern harrier (*Circus cyaneus*). In *Colorado Breeding Bird Atlas*, edited by H. E. Kingery. Denver: Colorado Bird Atlas Partnership & Colorado Div. of Wildlife.

CNHP. 2004. State-wide list of tracked species and communities, August 9, 2004. Accessed at http://www.cnhp.colostate.edu/.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 1999. Effects of management practices on grassland birds: northern harrier (revised 2003).

Duebbert, H. F. and J. T. Lokemoen. 1977. Upland nesting of American bitterns, marsh hawks, and short-eared owls. *Prairie Naturalist* 9:33-40.

Kantrud, Harold A. and Russell L. Kologiski. 1983. Avian associations of the northern Great Plains grasslands. *Journal of Biogeography* 10:331-350.

Leukering, T. and R. Levad. 2002. *Monitoring Colorado's Birds, 1998-2001*. Brighton: Rocky Mountain Bird Observatory.

MacWhirter, R. B. and K. L. Bildstein. 1996. Northern harrier (*Circus cyaneus*). In *The Birds of North America, No. 210*, edited by A. Poole and F. Gill. Philadelphia: The Birds of North America, Inc.

Martin, J. W. 1987. Behavior and habitat use of breeding northern harriers in southwestern Idaho. *Journal of Raptor Research* 21:57-66.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Arlington, Virginia: NatureServe.

Righter, R., R. Levad, C. Dexter, and K. Potter. 2004. *Birds of western Colorado plateau and mesa country*. Grand Junction: Grand Valley Audubon Society.

Ryser, F. A. 1985. *Birds of the Great Basin: a natural history*. Reno: University of Nevada Press.

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*, edited by T. E. Martin and D. M. Finch. New York: Oxford University Press.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003: USGS Patuxent Wildlife Research Center.

Serrentino, P., K. Schneider, G. Hammerson, M. Koenen, and D. W. Mehlman. 1992. Species management abstract: northern harrier. Arlington, Virginia: The Nature Conservancy.