

# Northern Harrier



Northern Harrier (*Circus cyaneus*)



Photo credits: Jeff Nadler

**Scientific Name** *Circus cyaneus*  
(Linnaeus, 1766)

**Family Name** Accipitridae  
Hawks, Kites, Eagles

## Did you know?

Unlike most hawks, harriers can use their sense of hearing to help locate prey. Harriers have an owl-like facial disk to help with directional hearing and soft feathers for a quieter flight.

## Summary

**Protection** Threatened Species in New York State, protected federally.

This level of state protection means: any species which meet one of the following criteria:

1) Any native species likely to become an endangered species within the foreseeable future in New York. 2) Any species listed as threatened by the U.S. Department of the Interior.

**Rarity** G5, S3B,S3N

A global rarity rank of G5 means: Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

A state rarity rank of S3B,S3N means: Typically 21 to 100 breeding occurrences or limited breeding acreage and typically 20 to 100 non-breeding (usually winter residents) occurrences in New York State.

## State Ranking Justification

There were 354 probable and confirmed breeding blocks identified during the second Breeding Bird Atlas (McGowan and Corwin 2008) and 355 probable and confirmed breeding blocks identified during the first New York State Breeding Bird Atlas (1980-1985) (Andrle and Carroll 1988). However, these numbers could be deceptive since they are cumulative over several years and the birds occupy large breeding territories (i.e. individuals reported in more than one block). They are widespread in winter, but numbers are highly variable. There is concern about the status of Northern Harrier populations in New York because of the loss of farmland and wetlands throughout the state.

This species is protected under the Migratory Bird Treaty Act. The Migratory Bird Treaty Act implements various treaties and conventions between the U. S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under this Act,

taking, killing, or possessing migratory birds, including nests or eggs, is unlawful unless specifically permitted by other regulations.

## Conservation Issues

### Threats

One of the most significant threats to Northern Harrier populations in New York is the loss of suitable grassland habitat. Economic factors have affected the viability of farms in New York. Many farmers have intensified their farming practices, converted hayfields to row crops, or abandoned farming altogether (Andrle and Carroll 1988, Post 2005). Remaining hayfields are often mowed earlier and more frequently to increase production. As a result, the mortality rate of young in those fields is high and sometimes adults are killed during mowing. As farms are abandoned they are lost to development or the land reverts to shrublands and forests. Grasslands are becoming more scattered and isolated thereby reducing connectivity (Post 2005). Another significant threat to Northern Harriers is the loss of wetland habitat by draining, dredging, and filling marshes (Evers 1992 cited in NatureServe 2003). New York State has lost over half of its wetlands since colonization (Tiner 1984 cited in NatureServe 2003). More recently, losses of wetlands in the Lake Plains portion of the state have been offset as agricultural lands revert back to wetlands, although net losses of wetlands in the Hudson Valley continue. Emergent marshes, which constitute only five percent of the state's 2.5 million acres, have declined overall. Equally important, the quality of remaining habitat is often degraded by fragmentation, exotic plants, and nutrient enrichment (Riexinger, personal communication, October 31, 2003). Ditching of salt marshes for mosquito control may have negative effects on breeding populations (Serrentino and England 1989).

### Management Considerations

Large areas of open habitat in breeding and wintering areas need to be maintained in order to ensure the persistence of this species in New York. Potential management practices include burning, mowing, and plowing of fields after the breeding season. Use Landowner Incentive Program funds to conserve privately-owned grasslands. Coordinate conservation efforts with other agencies and organizations and initiate an outreach program (Post 2005). It may also be possible to design a management plan that would include other threatened species with similar habitat requirements, such as the Short-eared Owl.

### Research Needs

Implement accurate and standardized survey methods to determine the population size in New York. Data should be collected on hunting habitat and roost site selection in various habitats such as salt marshes, freshwater wetlands, agricultural habitats, and maritime heaths. Determine the sizes of hunting ranges of birds during the breeding and non-breeding season at sites with varying densities and habitat types. Determine the causes of breeding failure and mortality in young and adults. Conduct studies on the techniques used to maintain early successional habitats. Comparisons between treatments and the cost-effectiveness of each treatment are especially needed. Determine the amount and type of disturbances that breeding Northern harriers will tolerate. In coastal areas, determine the effect of salt marsh ditching on populations and their major prey species.

## Short Term Trends

Northern Harrier populations vary with rodent populations, peaking about every five years. Breeding populations appear to be fairly stable when comparing the two breeding bird atlases of New York. During the first Breeding Bird Atlas (1980-1985), 355 probable or confirmed blocks were reported (Andrle and Carroll 1988). During the second Breeding Bird Atlas, probable or confirmed breeding was reported in 354 blocks (McGowan and Corwin 2008). Since Northern Harriers have a large home range, it is possible that individuals were reported in more than one block. Declines were noted by McGowan and Corwin (2008) in the Adirondacks, Coastal Lowlands, St. Lawrence Plains, and Tug Hill Plateau, while the number of reported blocks increased in the Champlain Valley to the northern Hudson Valley, Mohawk Valley, and Appalachian Plateau (McGowan and Corwin 2008). Breeding Bird Survey data show a possible decline of 3.8% per year between 1980 and 2006. Although, these findings were not found to be statistically significant (Sauer et al. 2007). Non-breeding populations appear to be their highest during spring and fall migration (Levine 1998). Wintering populations fluctuate with prey abundance and snow cover, but appear to be fairly stable.

## Long Term Trends

Until about the 1950s, breeding Northern Harriers were considered common throughout the state. Between the 1950s and 1960s the population started to decline for unknown reasons (Andrle and Carroll 1988, Levine 1998). The downward trend may be attributed to habitat loss ranging from reforestation and filling of wetlands to urban and industrial development (Serrentino 1992). Although it is not certain, pesticide use may have also played a role in the population decline (Levine 1998). Breeding Bird Survey data show a possible decline of 3.0% per year from 1966 to 2006. Although, these findings were not determined to be statistically significant (Sauer et al. 2007). Wintering populations appear to be fairly stable. Northern Harriers have been known to winter in areas where they are locally extirpated as breeders (Serrentino 1992).

## Habitat

Northern Harriers use a wide range of open grasslands, shrubland, and salt and freshwater marshes (Andrle and Carroll 1988, McGowan and Corwin 2008). Nests are placed on the ground, usually in dense cover.

### Associated Ecological Communities

#### **Brackish Meadow**

A moist, moderately well-drained brackish (salinity 0.5-18 ppt) perennial grassland with occasional isolated shrubs that is typically situated in a belt at the upper edge of salt marshes bordering sandy uplands, but may occupy large portions of interdunal basins. The community usually develops in areas with a unique combination of soils and hydrology, on deep deposits of periodically windblown or overwashed gleyed sands that are usually flooded only during spring tides and during major coastal storms, approximately two to three times per year.

#### **Brackish Tidal Marsh**

A marsh community that occurs where water salinity ranges from 0.5 to 18.0 ppt, and water is less than 2 m (6 ft) deep at high tide. The vegetation in a brackish tidal marsh is dense

and dominated by tall grass-like plants.

### **Deep Emergent Marsh**

A marsh community flooded by waters that are not subject to violent wave action. Water depths can range from 6 in to 6.6 ft (15 cm to 2 m). Water levels may fluctuate seasonally, but the substrate is rarely dry, and there is usually standing water in the fall.

### **Dwarf Pine Plains**

A woodland community dominated by dwarf individuals of pitch pine and scrub oak that occurs on nearly level outwash sand and gravel plains in eastern Long Island. The soils are infertile, coarse textured sands that are excessively well-drained.

### **Freshwater Tidal Marsh**

A marsh community that occurs in shallow bays, shoals, and at the mouth of tributaries of large tidal river systems, where the water is usually fresh (salinity less than 0.5 ppt), and less than 2 m (6 ft) deep at high tide. Typically there are two zones in a freshwater tidal marsh: a low-elevation area dominated by short, broadleaf emergents bordering mudflats or open water, and a slightly higher-elevation area dominated by tall grass-like plants.

### **Hempstead Plains Grassland**

A tall grassland community that occurs on rolling outwash plains in west-central Long Island. This community occurs inland, beyond the influence of offshore winds and salt spray.

### **High Salt Marsh**

A coastal marsh community that occurs in sheltered areas of the seacoast, in a zone extending from mean high tide up to the limit of spring tides. It is periodically flooded by spring tides and flood tides. High salt marshes typically consist of a mosaic of patches that are mostly dominated by a single graminoid species.

### **Low Salt Marsh**

A coastal marsh community that occurs in sheltered areas of the seacoast, in a zone extending from mean high tide down to mean sea level or to about 2 m (6 ft) below mean high tide. It is regularly flooded by semidiurnal tides. The mean tidal range of low salt marshes on Long Island is about 80 cm, and they often form in basins with a depth of 1.6 m or greater.

### **Maritime Grassland**

A grassland community that occurs on rolling outwash plains of the glaciated portion of the Atlantic coastal plain, near the ocean and within the influence of offshore winds and salt spray.

### **Maritime Shrubland**

A shrubland community that occurs on dry seaside bluffs and headlands that are exposed to offshore winds and salt spray.

### **Medium Fen**

A wetland fed by water from springs and seeps. These waters are slightly acidic (pH values generally range from 4.5 to 6.5) and contain some dissolved minerals. Plant remains in these fens do not decompose rapidly and thus the plants in these fens usually grow on

older, undecomposed plant parts of woody material, grasses, and mosses.

### **Salt Panne**

A shallow depression in a salt marsh where the marsh is poorly drained. Pannes occur in both low and high salt marshes. Pannes in low salt marshes usually lack vegetation, and the substrate is a soft, silty mud. Pannes in a high salt marsh are irregularly flooded by spring tides or flood tides, but the water does not drain into tidal creeks. After a panne has been flooded the standing water evaporates and the salinity of the soil water is raised well above the salinity of sea-water.

### **Shallow Emergent Marsh**

A marsh meadow community that occurs on soils that are permanently saturated and seasonally flooded. This marsh is better drained than a deep emergent marsh; water depths may range from 6 in to 3.3 ft (15 cm to 1 m) during flood stages, but the water level usually drops by mid to late summer and the soil is exposed during an average year.

### **Shrub Swamp**

An inland wetland dominated by tall shrubs that occurs along the shore of a lake or river, in a wet depression or valley not associated with lakes, or as a transition zone between a marsh, fen, or bog and a swamp or upland community. Shrub swamps are very common and quite variable.

### **Successional Old Field**

A meadow dominated by forbs and grasses that occurs on sites that have been cleared and plowed (for farming or development), and then abandoned or only occasionally mowed.

### **Successional Shrubland**

A shrubland that occurs on sites that have been cleared (for farming, logging, development, etc.) or otherwise disturbed. This community has at least 50% cover of shrubs.

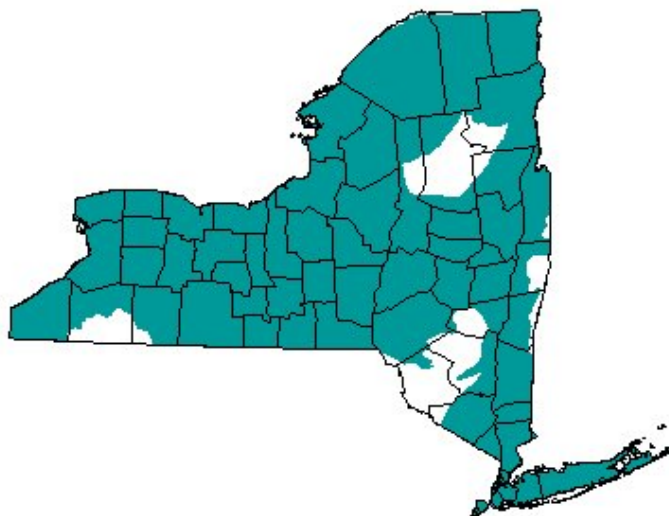
## **Other Probable Associated Communities**

- Alvar grassland
- Calcareous pavement barrens
- Dwarf shrub bog
- Inland salt marsh
- Salt shrub
- Successional northern sandplain grassland

## **Associated Species**

Short-Eared Owl (*Asio flammeus*)

# Range



The map shows the known locations for northern harrier (black dots) based on the New York Natural Heritage Program database and the first New York Breeding Bird Atlas. A general approximation of the potential breeding range (blue shading) throughout the state is based on the U.S. Forest Service Ecological Units (Keys et al. 1995).

## Data Sources

- New York Natural Heritage Program (Natural Heritage Element Occurrences)
- NYS GIS Data Sharing Cooperative, simplified by NYS Department of Environmental Conservation, Habitat Inventory Unit (County Boundary for New York State)
- U.S. Department of Agriculture, Forest Service (Subregions of the conterminous United States)
- The New York Breeding Bird Atlas

## Best Places to See

Fort Edward Grasslands (Washington County)  
Galeville Grasslands (Orange, Ulster Counties)  
Point Peninsula (Jefferson County)

## New York State Distribution

Northern Harriers are confirmed breeders in the western Great Lakes plain, open habitats of the Adirondacks, western Finger Lakes, Long Island, and the Hudson, Saint Lawrence, and Lake Champlain valleys. The winter range is similar depending on prey abundance and snow cover.

## Global Distribution

Breeding: In North America, the breeding range of the Northern Harrier ranges from northern Alaska to northern Saskatchewan and southern Quebec; south to northern Baja California, southern Texas, southern Missouri, West Virginia, southeastern Virginia, and North Carolina (and formerly Florida). They breed rarely or erratically south of the North American breeding range (MacWhirter and Bildstein 1996 cited in NatureServe 2003). In Eurasia, Northern Harriers can be found from the British Isles, Scandinavia, northern

Russia and Siberia south to the Mediterranean region, southern Russia, Turkestan, Amurland, Ussuriland, Sakhalin, and the Kurile Islands (AOU 1983 cited in NatureServe 2003). The breeding range is large but often highly discontinuous.

Non-breeding: During the non-breeding season, Northern Harriers are found in North America from southern Canada or the northern contiguous United States south through the United States, Middle America, and the Antilles to northern Columbia, Venezuela, and Barbados. They are considered casual or accidental in Hawaii (AOU 1983 cited in NatureServe 2003, MacWhirter and Bildstein 1996 cited in NatureServe 2003). In North America, Northern Harriers winter in the largest numbers in the Great Basin and central and southern Great Plains (Root 1988 cited in NatureServe 2003). The coastal areas of New York, New Jersey, Delaware, Maryland, and Virginia support the highest number of wintering birds in the Northeast (National Audubon Society 1971-74, 1982-83, 1985-87 cited in NatureServe 2003). In Eurasia, they are found from the British Isles, southern Scandinavia, and southern Japan south to northwestern Africa, Asia Minor, India, Burma, eastern China, and the Ryukyu Islands (AOU 1983 cited in NatureServe 2003).

## Identification Comments

### Identifying Characteristics

The Northern Harrier is a slim, medium-sized hawk with long, broad wings and long legs and tail. There are two features that are useful in identifying this species: a facial ruff that gives them an owl-like appearance and a white rump that is visible when in flight. Northern Harriers are known to fly low over fields and to hover in flight over prey. Sexes are dimorphic. Adult females are dark brown above and buffy below. There is some streaking in the underparts. The tail is barred. Males differ in that they are gray above and white below. Underparts have reddish spots. Wingtips are black. Males have brown dorsal markings until three to four years of age. Immature harriers are similar in appearance to females except they have a cinnamon-colored breast and the back and wings are darker brown. Immature plumage is retained until the following spring or summer. When laid, eggs are pale blue, but turn white after a few days. Some eggs have brown markings. Nests are built of grasses and sticks on the ground in thick vegetation of grassland or marshes. Northern harriers have a few vocalizations that are used in various situations. In general, the call is a weak, nasal whistle ("pee, pee, pee"). A "wailing squeal" is used by females to males and young to adults when begging for food. The same call can be heard during courtship. Incubating females may use a "quip, quip, quip" call.

### Behavior

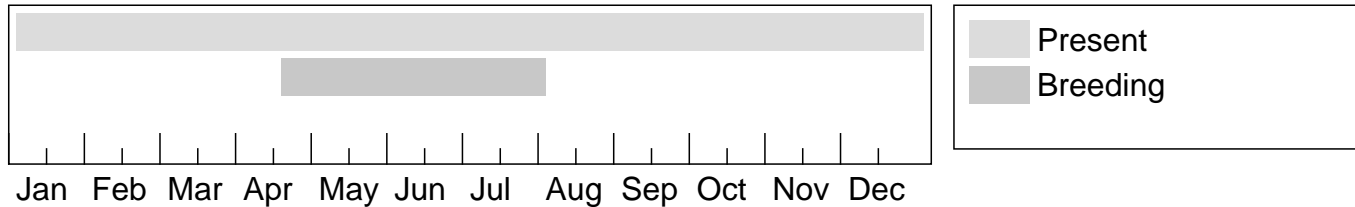
During the breeding season, males hunt farther away from the nest site than females. Northern Harriers are known to congregate during the winter months in open habitats with high rodent populations. They usually abandon wintering grounds with deep snow cover. They are known to share wintering grounds with other bird species, such as Short-eared Owls and Rough-legged Hawks.

## Diet

Northern Harriers prey upon rodents and small birds.

## The Best Time to See

Northern Harriers are found in New York throughout the year. During the breeding season, the best time to look for Northern Harriers is May through June. Concentrations of birds may be found in suitable habitat with abundant prey during the winter months.



**The time of year you would expect to find Northern Harrier in New York.**

## Similar Species

**Rough-Legged Hawk(*Buteo lagopus*):** Northern Harriers and Rough-legged Hawks are found in similar habitats during the winter. Rough-legged Hawks are larger and have a white tail with dark bands. They lack the white rump patch that is present on Northern Harriers. Northern Harriers also have an owl-like facial ruff. Both species are known to hover in flight.

**Short-Eared Owl(*Asio flammeus*):** Northern Harriers have an owl-like facial disk which may cause some confusion when initially trying to distinguish them from Short-eared Owls. Short-eared Owls lack the distinctive white rump patch of Northern Harriers.

## Taxonomy

**Kingdom** Animalia

└ **Phylum** Craniata

└ **Class** birds (Aves)

└ **Order** Raptors (Falconiformes)

└ **Family** Accipitridae (Hawks, Kites, Eagles)

## Additional Common Names

Marsh Hawk

# Additional Resources

## Links

### NatureServe Explorer

<http://natureserve.org/explorer/servlet/NatureServe?searchName=CIRCUS+CYANEUS>

### Google Images

<http://images.google.com/images?q=CIRCUS+CYANEUS>

### New York State Department of Environmental Conservation

<http://www.dec.ny.gov/animals/7090.html>

## References

- American Ornithologists' Union (AOU). 1983. Check-list of North American Birds, 6th edition. Allen Press, Inc., Lawrence, Kansas. 877 pp.
- Andrle, Robert F. and Janet R. Carroll, editors. 1988. The atlas of breeding birds in New York State. Cornell University Press. 551 pp.
- Balfour, E., and M. A. MacDonald. 1970. Food and feeding behavior of the hen harrier in Orkney. Scot. Birds 6:157-66.
- Bent, A.C. 1937. Life histories of North American birds of prey. Part 1. Bull. U.S. Natl. Mus. 137. 409 pp.
- Bildstein, K. L. 1988. Northern harrier. Pages 251-303 in R. S. Palmer (editor). Handbook of North American Birds. vol. 4 Diurnal Raptors (Part 1). Yale University Press, New Haven, Connecticut.
- Birney, E. C., W. E. Grant, and D. D. Baird. 1976. Importance of vegetative cover to cycles of *Microtus* populations. Ecology 57:1043-51.
- Brown, L. and D. Amadon. 1968. Eagles, Hawks, and Falcons of the World. McGraw-Hill, NY.
- Bull, John. 1974. Birds of New York State. Doubleday, Garden City, New York. 655 pp.
- Byrd, M. A., and D. W. Johnston. 1991. Birds. Pages 477-537 in K. Terwilliger, coordinator. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publ. Co., Blacksburg, Virginia.
- Clarke, J. A., B. A. Harrington, T. Hruby, and W. E. Wasserman. 1984. The effect of ditching for mosquito control on saltmarsh use by birds in Rowley, Massachusetts. Journal of Field Ornithology 55:160-80.
- Collopy, M. W., and K. L. Bildstein. 1987. Foraging behavior of northern harriers wintering in southeastern saltand freshwater marshes. Auk 104:11-16.
- Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1992. Birds in Jeopardy: the Imperiled and Extinct Birds of the United States and Canada, Including Hawaii and Puerto Rico. Stanford University Press, Stanford, California. 259 pp.
- Evans, D. L. 1982. Status reports on twelve raptors. U.S. Department of the Interior, Fish and Wildlife Service, Special Scientific Report No. 238. 68 pp.
- Evers, D. C. 1992. A guide to Michigan's endangered wildlife. Univ. Michigan Press, Ann Arbor. viii + 103 pp.
- Fisher, A.K. 1893. The hawks and owls of the United States in their relation to agriculture. Washington U.S. Dept. of Agriculture Bull. no. 6. 210 pp.

- Hamel, P. B. 1986. Bachman's warbler. A species in peril. Smithsonian Inst. Press, Blue Ridge Summit, PA. 109 pp.
- Hamerstrom, F. 1969. A harrier population study. Pages 367-83 in J. J. Hickey (editor). Peregrine falcon populations: their biology and decline. University of Wisconsin Press, Madison, Wisconsin. 596 pp.
- Hamerstrom, F. 1986. Harrier, hawk of the marshes. Smithsonian Inst. Press, Washington, D.C. 172 pp.
- Hands, H. M., R. D. Drobney, and M. R. Ryan. 1989. Status of the northern harrier in the northcentral United States. Missouri Coop. Fish Wildl. Res. Unit Rep. 18 pp.
- Herkert, J. R., editor. 1992. Endangered and threatened species of Illinois: status and distribution. Vol. 2: Animals. Illinois Endangered Species Protection Board. iv + 142 pp.
- Johnsgard, P. A. 1990. Hawks, eagles, and falcons of North America. Smithsonian Inst. Press, Washington, D.C. xvi + 403 pp.
- Johnson, D. H., and L. D. Igl. 2001. Area requirements of grassland birds: a regional perspective. *Auk* 118:24-34.
- Keys, Jr., J.; Carpenter, C.; Hooks, S.; Koenig, F.; McNab, W.H.; Russell, W.; Smith, M.L. 1995. Ecological units of the eastern United States - first approximation (cd-rom), Atlanta, GA: U.S. Department of Agriculture, Forest Service. GIS coverage in ARC/INFO format, selected imagery, and map unit tables.
- Kirk, D. A., D. Hussell, and E. Dunn. 1995. Raptor population status and trends in Canada. *Bird Trends (Canadian Wildlife Service)* 4:2-9.
- Levine, E. 1998. Bull's birds of New York State. Comstock Publishing Associates, Ithaca, NY.
- Loucks, Barbara Allen. 1992. Critical habitat components for the northern harrier (*Circus cyaneus*) in New York State. Draft Manuscript. 15 pp.
- MacWhirter, R.B., and K.L. Bildstein. 1996. Northern Harrier (*Circus cyaneus*). In A. Poole and F. Gill, editors, *The Birds of North America*, No. 210. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, DC. 32 pp.
- McGowan, K.J. and K. Corwin, eds. 2008. *The atlas of breeding birds in New York State: 2000-2005*. Cornell University Press, Ithaca, NY. 688 pp.
- National Audubon Society. 1971. Seventy-first Christmas Bird Count. *Audubon Field Notes* 25:121-514.
- National Audubon Society. 1972. Seventy-second Christmas Bird Count. *Audubon Field Notes* 26:137-530.
- National Audubon Society. 1973. Seventy-third Christmas Bird Count. *Audubon Field Notes* 27:135-540.
- National Audubon Society. 1974. Seventy-fourth Christmas Bird Count. *Audubon Field Notes* 28:165-555.
- National Audubon Society. 1982. Eighty-second Christmas Bird Count. *Audubon Field Notes* 36:69-403.
- National Audubon Society. 1983. Eighty-third Christmas Bird Count. *Audubon Field Notes* 37:69-408.
- National Audubon Society. 1985. Eighty-fifth Christmas Bird Count. *Audubon Field Notes*

39:383-834.

- National Audubon Society. 1986. Eighty-sixth Christmas Bird Count. Audubon Field Notes 40:589-1071.
- National Audubon Society. 1987. Eighty-seventh Christmas Bird Count. Audubon Field Notes 41:579-1321.
- NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 26, 2004).
- NatureServe. 2005. NatureServe Central Databases. Arlington, Virginia. USA
- New York State Department of Environmental Conservation. 2005. New York State Breeding Bird Atlas Database. Division of Fish and Wildlife, Albany, NY.
- Palmer, R. S., editor. 1988. Handbook of North American birds. Vol. 4. [Diurnal raptors, part 1]. Yale University Press, New Haven, CT. vii + 433 pp.
- Pendleton, B. A. G., B. A. Millsap, K. W. Cline, and D. M. Bird. 1987. Raptor management techniques manual. National Wildlife Federation, Sci. and Tech. Ser. No. 10. 420 pp.
- Post, Tim. 2004. State wildlife comprehensive plan- draft species group report for grassland birds. In: New York State Department of Environmental Conservation. Comprehensive wildlife conservation strategy species reports for: Birds. 114 pgs. September 24, 2004.
- Post, Tim. 2005. Breeding Bird Atlas notable species form on northern harrier in blocks 6275D and 6274B of July 8, 2002.
- Root, T. 1988. Atlas of wintering North American birds: An analysis of Christmas Bird Count data. University of Chicago Press. 336 pp.
- Sauer, J.R., J.E. Hines, and J. Fallon. 2007. The North American breeding bird survey, results and analysis 1966-2006. Version 10.13.2007. US Geological Survey, Patuxent Wildlife Research Center, Laurel, MD.
- Serrentino, P. 1992. Northern harrier, *Circus cyaneus*. Pages 89-117 in K. J. Schneider and D. M. Pence, editors. Migratory nongame birds of management concern in the Northeast. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts. 400 pp.
- Serrentino, P., and M. England. 1989. Raptor status reports: northern harrier. Pages 37-46 in B. G. Pendleton (editor). Proceedings of the Northeast raptor management symposium and workshop. National Wildlife Federation, Washington, D.C.
- Simmons, R., et al. 1986. The influence of microtines on polygyny, age, and provisioning of breeding northern harriers: a 5-year study. Canadian J. Zool. 64:2447-2456.
- Stiles, F. G. and A. F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University Press, Ithaca, New York, USA. 511 pp.
- Terres, J. K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York.
- Tiner, R.W. 1984. Wetlands of the United States: current status and recent trends. U.S. Fish and Wildlife Service. Newton Corner, MA. 59 pp.
- Titus, K., and M. R. Fuller. 1990. Recent trends in counts of migrant hawks from northeastern North America. Journal of Wildlife Management 54:463-470.
- Watson, D. 1977. The hen harrier. T.E.A.D. Poyser, Limited, Berkhamsted, Hertfordshire, England.

307 pp.

---

**New York Natural Heritage Program**

625 Broadway, 5th Floor,  
Albany, NY 12233-4757  
Phone: (518) 402-8935  
acris@nynhp.org

This project is made possible with funding from:

- New York State Department of Environmental Conservation Hudson River Estuary Program
- Division of Lands & Forests, Department of Environmental Conservation
- New York State Office of Parks, Recreation and Historic Preservation

Information for this guide was last updated on Oct 29, 2009