The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Hints For Protecting Habitat In The Kittatinny Raptor Corridor

As more and more wildlife habitat and open space is lost to development along the Kittatinny raptor corridor, an increasingly urgent need has developed to set aside and preserve as much habitat as possible. Fortunately, some time remains to take necessary action in many sections of the corridor. Moreover, there are various techniques that can be used to save land. The methods listed in this bulletin are especially useful and recommended.

- Encourage land owners to protect land (habitat) as wildlife refuges.

- Donate land as a wildlife refuge to a nonprofit wildlife conservation organization (the Wildlife Information Center, Inc., is interested in some sites under some circumstances), or sell it at minimal cost to land conservancies.

- Purchase land and establish it as a wildlife sanctuary.

- Be sure proposed subdivision developments meet all local zoning and subdivision requirements. If none exist in your town or township, work to secure them.

- If a proposed subdivision threatens protected wetlands, seek immediate help from the U. S. Army Corps of Engineers, U. S. Environmental Protection Agency, U. S. Fish and Wildlife Service, and your state environmental protection department. Federal laws and regulations protect wetlands, and many state laws also do so.

- Seek help from naturalists or wildlife biologists to determine if endangered or threatened animals and/or plants are present on proposed subdivision sites. If threatened or endangered species are present, developers may be required to take steps to protect that habitat. Otherwise, encourage them to do so voluntarily.

- Encourage forest and woodlot owners not to fragment those habitats via logging, or subdivide it for development.

- Avoid cutting large dead trees with cavities which can provide homes for wildlife.

- Plant native trees, wild flowers, and other vegetation to enhance suitable wildlife areas, including rural roadsides.

- Encourage local and county governmental officials to set aside important or unique natural areas as special wildlife refuges.

- Encourage owners of business or industry property to preserve important or unique natural areas as special wildlife refuges.

- Encourage your family, friends, and neighbors to join in your efforts to protect habitat.

- Encourage state legislators to pass legislation providing for coordinated state level environmental review of proposed land speculation and subdivision projects.

- Encourage state legislators to pass legislation giving major tax relief benefits to people who preserve land they own as inviolate wildlife refuges.

- Join the Wildlife Information Center, Inc., to help support our efforts to protect wildlife habitat along the Kittatinny raptor corridor.

Suggested Reading

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1987 The Naturalist's Garden. Rodale Press, Emmaus, PA.

Heintzelman, Donald S.
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Johnson, Lady Bird and Carlton B. Lees
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Habitat Bulletin No. 2

The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Wetlands, Wildlife, And People In The Kittatinny Raptor Corridor

Wetlands are semi-aquatic lands that are flooded during at least a portion of the year. Particular plants that grow in saturated soil help us to identify wetland areas. Marshes, swamps, bogs, and potholes are among the more familiar types of wetland ecosystems.

Wetlands occur throughout the Kittatinny raptor corridor, and there is probably a wetland near your home. Once viewed as wastelands that bred mosquitoes and produced unpleasant odors, wetlands are now better understood as critically important ecosystems for wildlife and people alike.

Over one-half of the original wetlands of the lower 48 states have been lost to human activity such as agriculture and development. The losses continue today in spite of federal and state laws passed to protect wetland areas.

- Wetlands are vital habitat for many plant species. Some plants such as sundew and pitcher plants grow only in wetlands, and grow only in specific types of wetlands.

- Many animals depend on wetlands for food, shelter, and breeding grounds during all or part of their life cycle. Wetland water is rich in organic food material that serves as an important base for many food webs.

In addition to their vitally important values to wildlife, wetlands are important to people for a variety of reasons.

- Wetlands filter water, improving its quality and preventing pollution.

- Wetlands act like giant sponges, absorbing rainwater runoff to help prevent flooding.

- Along rivers and coastlines, wetlands help control erosion.

- Wetlands are ideal areas for environmental education activities. They also have great aesthetic and recreational value. They are increasingly utilized in non-consumptive activities such as hiking, canoeing, bird watching, photography, and nature study.

The Wildlife Information Center, Inc., strongly supports wetlands protection. You also can help to protect wetlands by asking elected officials to make sure wetlands are legally protected. If you know of a wetland development activity that may be illegal, contact your state environmental department or your regional office of the U. S. Army Corps of Engineers and the U. S. Environmental Protection Agency. Help fight to save wetlands!

Suggested Reading

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Kusler, Jon A. and Mary E. Kentula (Editors
1990 Wetland Creation and Restoration/The Status of the Science. Island Press, Covelo, Ca.

Pennsylvania Department of Environmental Resources
1990 Wetlands Protection: A Handbook for Local Officials. Environmental Planning Information Series Report #7. Pa. Dept. Environmental Resources, Harrisburg, Pa.

U. S. Environmental Protection Agency
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Habitat Bulletin No. 3

The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Forest Fragmentation and Wildlife Loss In The Kittatinny Raptor Corridor

The impact of forest fragmentation upon a wide variety of North American wildlife is increasingly serious. Research is showing that the habitats of an alarmingly long list of species are threatened by forest and woodland fragmentation. The following facts pertain to this vital wildlife protection matter.

- Human activities that cause forest and woodland fragmentation include highway right-of-way construction, logging, and subdivisions and developments and their associated building lots, driveways, and access roads.

- Major ecological changes result when forest and woodland is fragmented.

- More than 100 forest and woodland migratory, neotropical bird species are threatened by habitat loss in fragmented forests and woodlands. Flycatchers, thrushes, vireos, and wood warblers are most seriously threatened. These are some of our most unique wildlife species.

- The more-than-100 forest and woodland migratory, neotropical bird species also are threatened by drastically increased predation rates by domestic cats and dogs, Blue Jays, Brown-headed Cowbirds, Opossums, and Raccoons. These animals gain access to forest and woodland interior core areas via highway cuts, access roads, driveways, building lots, and logged areas.

- Normal predation rates on migratory birds in very large, unfragmented forests are about 2 percent. **Abnormal predation rates on migratory birds in fragmented forests and woodlands range between 18 and 95 percent.**

- Different species of migratory, neotropical birds require different minimum amounts of unfragmented forest and woodland to breed successfully. Examples are Great Crested Flycatchers = 3 hectares (1 hectare contains about 2.47 acres), Eastern Wood Pewee = 10 hectares, Wood Thrushes = 20 hectares, Veeries and Ovenbirds = 100 hectares, Black-and-white Warblers = 300 hectares, and Worm-eating Warblers = 1,000 hectares.

- Forest and woodland fragmentation quickly eliminates deep interior forest species from living in those areas, breeding successfully, and surviving.

- The impact of forest and woodland fragmentation in North America on the survival rates of large numbers of migratory, neotropical bird species is further compounded by rapidly increasing losses of tropical forests in Latin America.

- Unfragmented forests have vital watershed, wildlife, and aesthetic values of great ecotourism importance. Developers, subdividers, and loggers rarely consider these values.

Recommendation

The Wildlife Information Center, Inc. strongly recommends that forests and woodlands along the Kittatinny raptor corridor in Pennsylvania, New Jersey, and New York not be further subjected to subdivisions and developments, or activities such as logging and quarrying. The wildlife and watershed values of these areas, plus their aesthetic and ecotourism values, require they be protected and preserved in the overall public interest.

Suggested Reading

Galli, Anne E., Charles F. Leck, and Richard T. Forman
1976 Avian Distribution Patterns in Forest Islands of Different Size in Central New Jersey. *Auk*, 93: 356-364.

Hagan III, John M. and David W. Johnston
1992 Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington, D. C.

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Habitat Bulletin No. 4

The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Taking Precautions When Using Lawn Care Chemicals In The Kittatinny Raptor Corridor

The Wildlife Information Center, Inc. is very concerned about the environmental and health impacts of the application, either professionally or by the homeowner, of lawn care chemicals which contain pesticides, herbicides, insecticides, and other compounds. The following facts are pertinent to this issue.

- Lawn care chemicals are suspected of having grave health effects on pregnant women, elderly people, small children, chemically sensitive people, asthma and allergy suffers, pets, and wildlife. Take strong safety precautions!

- Be aware that insecticides, herbicides, and pesticides used by lawn care companies, and those which are contained in over-the-counter products, are very toxic and dangerous. One example is 2,4-D, a herbicide still used today.

- Consumers **cannot** assume that chemicals registered with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) are safe and will not pose a danger. Many of the chemicals are being re-tested for safety by new sophisticated methods.

- **Do not** assume "inert" ingredients to be safe! Many lawn care products list chemicals which are not "active" (meaning killing) ingredients as "inert" ingredients. "Inert" chemicals carry or dissolve the "active" chemicals. They do not meet the same test requirements as "active" chemicals yet they can be known toxins such as asbestos and benzene.

- As a consumer, **demand** a complete list of chemicals to be sprayed, along with precautions to take to protect yourself **before** the date of applications.

- Be aware of companies which do not send "certified" chemical applicators and whom are not wearing protective gear such as gloves and respirator. Applicators who are not properly trained pose a danger to the public. They also may provide inaccurate answers to consumer questions.

- The most dangerous problem with lawn chemical application is inevitable chemical migration. They will drift in wind and run-off in rain. **Never apply the chemicals on a windy day, on steeply sloping areas, or near streams and ponds.**

- **Don't be lulled by ads into thinking that lawn care chemicals are safe. Consumers must weigh the benefits of a greener lawn against the uncertain long-term health problems. Remember, the spraying of potentially hazardous lawn care chemicals is an INTENTIONAL act of chemical exposure to yourself, family, pets, and wildlife.**

Suggested Reading

Abrams, Robert
1987 Lawn Care Pesticides: A Guide for Action. Attorney General of New York State, Department of Law, Environmental Protection Bureau, Albany, N. Y.

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Developing Model Schoolyard Wildlife Refuges In The Kittatinny Raptor Corridor

Schools within the Kittatinny raptor corridor have valuable opportunities to educate teachers and students, as well as the general public, about the conservation importance of wildlife habitat preservation by developing model schoolyard wildlife refuges.

These refuges need not be large -- perhaps an acre or less if the amount of land around a school is limited. Nevertheless, having teachers and students develop a special environmental education project that turns schoolyard lawn into wildlife habitat for small birds, mammals, butterflies, and wildflowers gives everyone involved an impressive hands-on wildlife conservation opportunity and learning experience.

After a schoolyard wildlife refuge is established, there also are endless opportunities available to conduct studies of the wildlife and wild plants that inhabit the refuge. Indeed, year after year, students at a school could catalog the refuge's biodiversity, wild species population changes, and ecological interactions.

In order to develop as much biodiversity as possible on a schoolyard wildlife refuge, the following recommendations should be followed whenever possible:

- Plant wildflowers to attract butterflies, some small birds, and provide protective cover for various wildlife species. The books listed in the suggested reading section dealing with wildflowers contain names and addresses of companies that sell wildflower seeds.

- Plant trees and shrubs that produce berries and fruits that are attractive to birds and other wildlife, and in which some bird species can nest.

- Keep the schoolyard wildlife refuge free from spraying of insecticides and pesticides. Encourage using organic gardening methods, including use of compost to improve soil conditions.

- Place one or more Eastern Bluebird nest boxes within the refuge.

- Place a bat roosting box within the refuge.

- Place bird feeders within, or close to, the refuge. This should be done, however, <u>only</u> if the feeders can be maintained regularly -- even during winter holiday vacations.

Valuable information is contained in the following references. In addition, many bird watching and other natural history and wildlife magazines contain names and addresses of companies that sell bird and bat houses, bird feeders, and related supplies. Having students find these references in the school library, or obtaining them via inter-library loan, produces improved library skills and necessary information for the development of a model schoolyard wildlife refuge.

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Grubb, Thomas C., Jr.
1986 Beyond Birding: Field Projects for Inquisitive Birders. Boxwood Press, Pacific Grove, CA.

Harrison, George H.
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Heintzelman, Donald S.
1983 The Birdwatcher's Activity Book. Stackpole Books, Harrisburg, PA.

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Landscape Linkages, Animal Movements, and the Kittatinny-Shawangunk Raptor Corridor

Within recent years, intense interest and concern has developed among conservation biologists, wildlife conservation organizations, governmental agencies, and private citizens regarding the increasingly urgent need to preserve biological diversity, wild species habitats, and ecosystems in the United States and elsewhere throughout the world.

This interest and concern is long overdue because the magnitude and speed of human-caused biodiversity extinction in tropical forests where many North American migratory birds spend their winters, but also in temperate areas, is progressing at a rate unknown since the extinction of the dinosaurs.

Wildlife movement corridors and certain other types of landscape linkages are receiving intense examination, and increasingly are being established. The following are important reasons why it is necessary to preserve biodiversity, wild species habitats, and ecosystems in the Kittatinny-Shawangunk Ridge and raptor corridor:

- It provides an internationally important landscape link and wildlife movement corridor connecting New England, Adirondack, Catskill, and Pocono Mountain breeding grounds with wintering grounds in the southeastern United States, Latin American, and the West Indies for numerous migratory birds. Some of these species are rare, threatened, or endangered.

- It allows for migratory movements, and local travel, for various wildlife species. For example, annual autumn hawk flights along the Kittatinny-Shawangunk Ridge are famous as one of the world's great bird migration spectacles.

- It permits gene flow among wild animal and plant species and populations. Plants, for example, can propagate and slowly disperse their seeds along the corridor, and wildlife including birds and mammals experience gene flow necessary for genetically healthy populations.

- It permits movement of wild animal and plant populations within and between habitats and ecosystems after environmental changes or natural disasters occur outside the raptor corridor.

- It allows, aids, and links recolonization of surviving individuals of exterminated local populations with habitats and ecosystems dispersed widely across landscapes. This is increasingly important as land speculation and development, and other human activities such as logging and mining fragment and/or destroy more and more wild species habitats in New England and the Middle Atlantic states.

Suggested Reading

Beiber, Paul and Steve Loe
1992 A Checklist for Evaluating Impacts to Wildlife Movement Corridors. *Wildlife Society Bulletin*, 20: 434-440.

Berle, Peter A.
1990 The Adirondack Park in the Twenty First Century. State of New York, Albany, NY

Davis, George D.
1988 Fulfilling The Promise Of The Adirondack Park/2020 Vision. Vol. 1. Biological Diversity: Saving All The Pieces. The Adirondack Council, Elizabethtown, N. Y.
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Noss, Reed F.
1992 The Wildlands Project. *Wild Earth* (special issue): 10-25.

Soulé, Michael
1992 A Vision for the Meantime. *Wild Earth* (special issue): 7-8.

Sutherland, Sanburn
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The Kittatinny Raptor Corridor Project
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Wildlife Information Center, Inc.
Allentown, Pa.

Restoring Old Growth Forest Islands in the Kittatinny-Shawangunk Raptor Corridor

The Kittatinny-Shawangunk Raptor Corridor contains potential opportunities at some places to restore islands of old growth forests, with existing second and third growth woodland connecting these islands. Old growth forests are stands of native trees at least 250 years old -- and in some cases as aged as 500 or more years. The Appalachian Trail, which runs along part of the Kittatinny Ridge in New Jersey and Pennsylvania, would provide access to ridgetop old growth forest islands.

Can this be accomplished after most pre-Colombian old growth forests along the ridge and corridor were cut down long ago? Yes -- provided conservationists think of old growth forest restoration as a unique gift to future citizens living within the raptor corridor. There are several techniques that can be used.

- We can identify isolated, or small clusters of, old growth trees on public and private lands on the Kittatinny-Shawangunk Ridge or in woodlots within the corridor. These are key pioneer trees because they serve as the nucleus around which future islands of old growth forests can be developed. For example, at one private site in Carbon County, Pa., a small cluster of old growth Hemlocks and White Pines exists. Those trees could form the nucleus of one old growth forest island. Similarly, in the vicinity of Bear Rocks atop the Kittatinny Ridge on the Carbon-Lehigh-Schuylkill County border, there remains another nucleus of old growth Hemlocks and White Pines. That is a second location that could be established as an old growth forest island.

- The Center will work with public and private land owners to encourage them to select and allow islands of second or third growth woodlands or woodlots to remain uncut and revert to old growth forests within the next 250 or more years. In the case of some privately owned lands, owners could donate restrictive timber cutting easements to the Wildlife Information Center thereby assuring for all time old growth forest preservation for those sites. At other privately owned locations, such as The Mohonk Trust and Hawk Mountain Sanctuary, old growth forest restoration process can begin merely by establish binding policies requiring that specific sections of their properties remain intact as old growth forest.

- In some other locations, small islands of old growth forests exist in public or private ownership. They are at the mature (climax) stage of their ecological development, and deserve the most careful and continuing protective attention. They provide spectacular visual and ecological examples of what can be expected after 250 or more years of old growth forest restoration efforts are successfully completed. Therefore, special efforts will be made to seek to protect and preserve those ancient forests from logging or other destructive activities.

• Efforts currently are underway by various researchers to develop blight-resistant American Chestnut (*Castanea dentata*) trees. When that effort is successful, it will be possible to restore those trees to Appalachian mountain forests where, prior to the early years of this century, chestnut trees were a major provider of food for wildlife, and a significant part of the forest canopy. Hence, within the next 250 years, it is possible that the Kittatinny-Shawangunk Ridge forest again will contain its original tree species composition with American Chestnuts forming much of the forest canopy and providing abundant food for wildlife.

• When the Wildlife Information Center secures its wildlife refuge and headquarters, part of the properly will be placed in a restricted status where natural plant succession over the next 250 years will produce old growth forest. By then, visitors to the sanctuary will enjoy the extraordinary opportunity to see terrestrial plant succession stages ranging from fields a few years old to old growth forest. We won't see the end results of restoring an old growth forest, but we will take the first steps to influence what future generations will see and appreciate.

• Schools in the raptor corridor can restore old growth trees to their campus by selecting a few existing trees, in good health and already as old as possible, and designating them as old growth restoration trees. Year after year, decade after decade, future generations of students can carefully protect and measure the growth of those special trees. Finally, after 250 or more years of care and appreciation, future students will have old growth trees growing on their campus.

To restoration old growth forests within the Kittatinny-Shawangunk raptor corridor requires far sighted vision, very long-term patience on the part of generations of conservationists, and equally far-sighted commitment by public officials and private land owners. Generations of people can make it happen. The task is exciting -- and possible. Nature has the capability to restore old growth forests. Let us get on with our part in the process!

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Wildlife Bulletin No. 1

The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring *A* Mountain's Vital Signs

Wildlife Information Center, Inc.

Slatington, Pa.

Bald Eagles In The Kittatinny Raptor Corridor

The Kittatinny Ridge and its corridor crosses parts of New York, New Jersey, and Pennsylvania. It beings near New Paltz, New York, where the ridge is called the Shawangunk Range, continues across northwestern New Jersey, and continues southward to its termination northwest of Carlisle, Pa. This bulletin presents information about Bald Eagles, an endangered species that migrates along the Kittatinny Ridge and its corridor

BALD EAGLE (*Haliaeetus leucocephalus*)

Bald Eagles once were common, but now are scarce expect in Alaska and Canada. In 1782, the Bald Eagle was adopted as our national bird. Today it is protected, but endangered.

Males measure about 3 feet from head to tail, weigh 8-10 pounds, and have a wingspread of about 6.5 feet. Females are somewhat larger. The birds have pale eyes, a yellow bill, and powerful talons to capture prey such as fish. Adults develop a white head when 5 to 6 years old.

Bald Eagles pair for life, but if one dies the survivor accepts a new mate. Eagles migrate great distances, but return to nest within about 100 miles of where they were raised. They build huge stick nests in trees near rivers, lakes, or marshes. Nests are reused year after year.

Bald eagles lay 2 to 3 eggs which hatch after 35 days of incubation. Eaglets fly within 3 months and are on their own about a month later. About half survive the first year.

Fish is the most important food for Bald Eagles. They also scavenge carrion, and in winter gather in some remote areas where fish or other prey is plentiful. During winter, when some Bald Eagles tend to concentrate along the Delaware River within the Delaware Water Gap National Recreation Area, the National Park Service conducts public eagle viewing opportunities. These activities generally are announced in park area newspapers and on television.

After World War II, DDT pollution threatened Bald Eagle survival. The chemical prevented them from reproducing, and few eaglets were hatched. In 1972, DDT was banned in the United States and Bald Eagles began recovering their former numbers. The following graph documents changes from 1961-1992 in age ratios of Bald Eagles observed in autumn migrating past Bake Oven Knob, Lehigh County, Pa. -- a major Kittatinny Ridge hawk migration observatory.

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1952 Eagle Man: Charles L. Broley's Field Adventures with American Eagles. Pellegrini & Cudahy, Publishers, New York, N. Y.

Gerrard, Jon M. and Gary R. Bortolotti.

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Part of this bulletin is adapted from information sheets issued by the U. S. Fish and Wildlife Service.

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The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

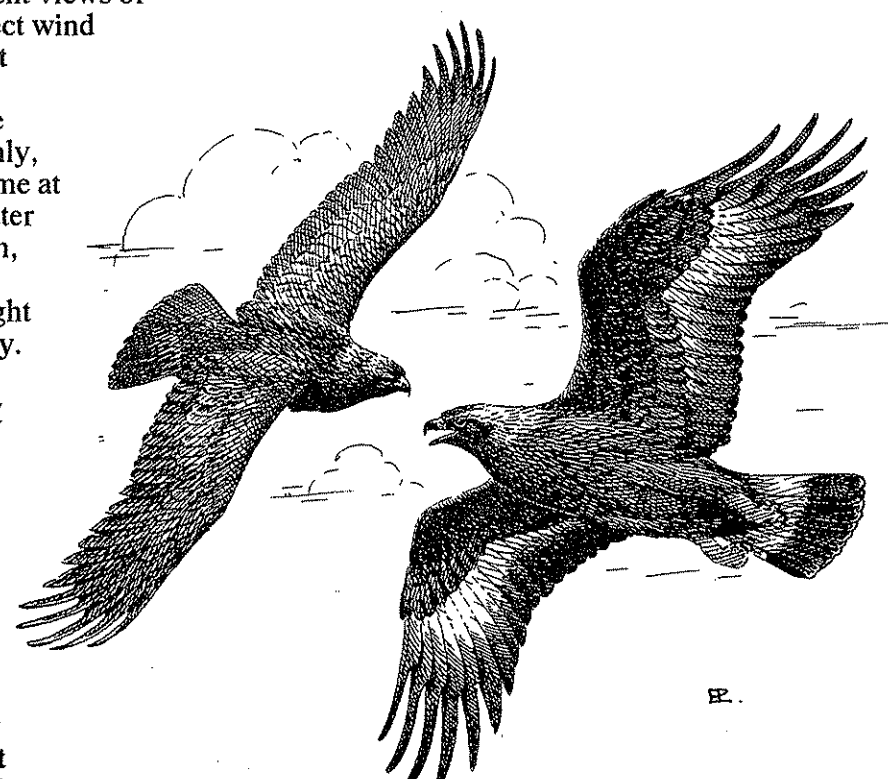
Wildlife Information Center, Inc.
Allentown, Pa.

Golden Eagles In The Kittatinny Raptor Corridor

Golden Eagles (*Aquila chrysaetos*) are the most spectacular, and among the rarest, birds seen along the Kittatinny Ridge and its corridor in New York, New Jersey, and Pennsylvania. They do not nest along the ridge or corridor, but are part of a small northeastern North American population that nests in remote parts of the Adirondacks of upstate New York, large forests of New England, and northeastern Canada.

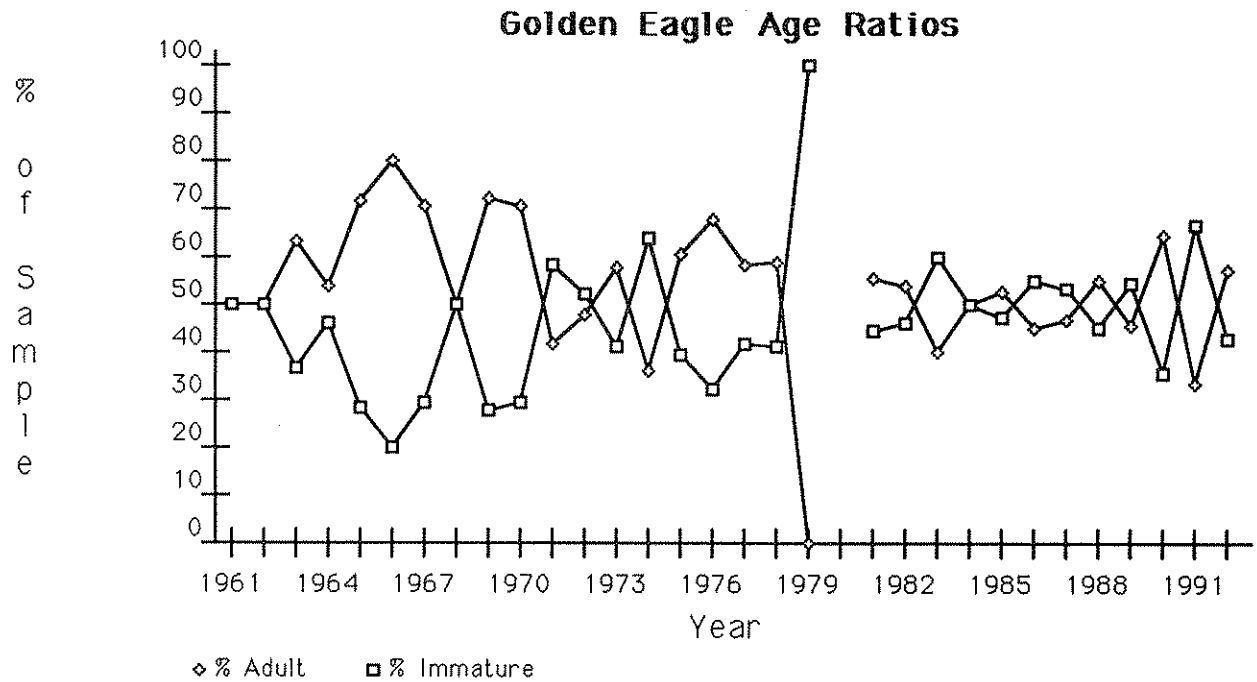
Although a few Golden Eagles sometimes are seen during winter along the raptor corridor, by far the largest numbers are seen during the autumn migration -- especially on cold, windy days with northwest winds during the period mid-October to mid-December.

Bake Oven Knob, Hawk Mountain, and Waggoner's Gap in Pennsylvania, and Raccoon Ridge in New Jersey, are among the famous Kittatinny Ridge hawk watching locations where it sometimes is possible to see excellent views of these spectacular eagles when correct wind and weather conditions occur. That is why many people annually visit these locations from across the United States and overseas. Certainly, if one is willing to spend enough time at any of these locations during the latter part of the autumn migration season, Golden Eagles will be seen. Occasionally, on red letter days, eight or more are observed in a single day. Both Golden and Bald Eagles, as with other birds of prey, are legally protected.



Golden Eagles in flight along the Kittatinny Ridge. Adult at left, immature at right. Drawings by Earl L. Poole.

At Bake Oven Knob, Pa. where long-term autumn hawk migration studies are in progress, careful efforts are made to record the ages of Golden Eagles observed passing the lookout. The following graph shows annual Golden Eagle age ratios since the early 1960s. Apparently these raptors suffered some reproductive failures during the DDT-era, although less so than more aquatically oriented Bald Eagles.



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The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Peregrine Falcons In In The Kittatinny Raptor Corridor

The Kittatinny Ridge and its corridor crosses parts of New York, New Jersey, and Pennsylvania. It beings near New Paltz, New York, where the ridge is called the Shawangunk Range, continues across northwestern New Jersey, and continues southward to its termination northwest of Carlisle, Pa. This bulletin presents information about Peregrine Falcons, an endangered species that migrates along the Kittatinny Ridge and its corridor.

PEREGRINE FALCON
(*Falco peregrinus*)

Peregrine Falcons long have been considered especially magnificent birds of prey. They are medium-sized falcons with long, pointed wings and a long tail. Adults have a slate blue-gray back, wings and flanks barred with black, a white face with a black stripe on each side, and large, dark eyes. Females are larger than males. Their aerial skills, grace, and speed are spectacular.

Peregrines reach adulthood at 2 years of age. The male arrives at a nesting site and begins aerial acrobatic displays to attract a mate. An average of 4 eggs is laid in spring. Incubation lasts about 33 days. Peregrines vigorously defend their nest, but may abandon it if severely or continuously harassed. The nest is a "scrape" or depression dug in gravel on a cliff ledge, usually overlooking a river. Peregrine nest cliffs have been called "ecological magnets."

Peregrines are specialized predators. They feed on medium-sized birds such as shorebirds, waterfowl, jays, and pigeons. They fly high above their intended prey, then "stoop" (dive) and strike their victim in mid-air. Some scientists estimate a stooping Peregrine reaches 200 or more miles per hour. Prey usually is killed instantly by the falcon's feet.

Peregrines live along mountain ranges, river valleys, and near coasts. Once they were common in the Appalachian mountains and valleys from New England to Georgia. They formerly nested on a cliff overlooking the Lehigh River at Lehigh Gap in eastern Pennsylvania, and certain reintroduction sites in proximity to the raptor corridor also may be in use.

Peregrines from northern Alaska, Canada, and Greenland migrate during autumn very long distances deep into South America. Small numbers annually appear along the Kittatinny Ridge. Peregrines that nest south of Canada migrate shorter distances, or even not at all.

Peregrine Falcons never were abundant. Perhaps 300 to 350 nesting pairs originally populated the eastern United States. After World War II, DDT pollution almost exterminated these breeding birds. The pesticide prevented the falcons from producing eggs with shells thick enough to withstand incubation.

In 1972, DDT was banned in the United States. This reduced DDT pollution in food chains in North America, but it still occurs in the environment in Latin American nations where many Peregrines spend the winter. Increasingly captively-reared falcons are being returned to the wild in the United States, and some of those falcons now also are breeding as wild birds.

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The Kittatinny Raptor Corridor Project

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Vultures In The Kittatinny Raptor Corridor

Two vulture species occur within the Kittatinny raptor corridor: Black Vulture and Turkey Vulture. Both scavengers are resident, as well as migratory. Turkey Vultures are the most common, but in recent years small numbers of Black Vultures are seen with increasing regularity.

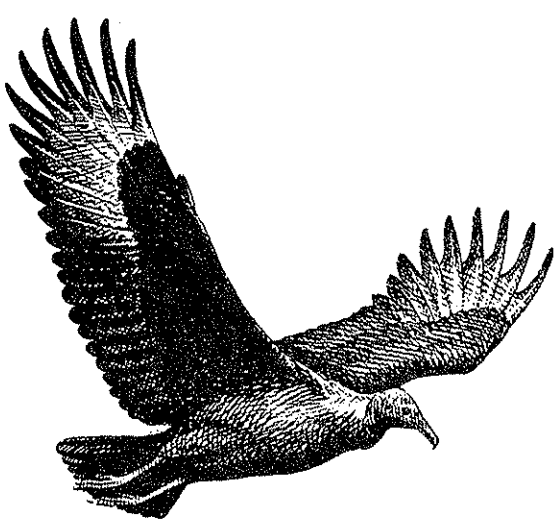
Black Vulture (*Coragyps atratus*)

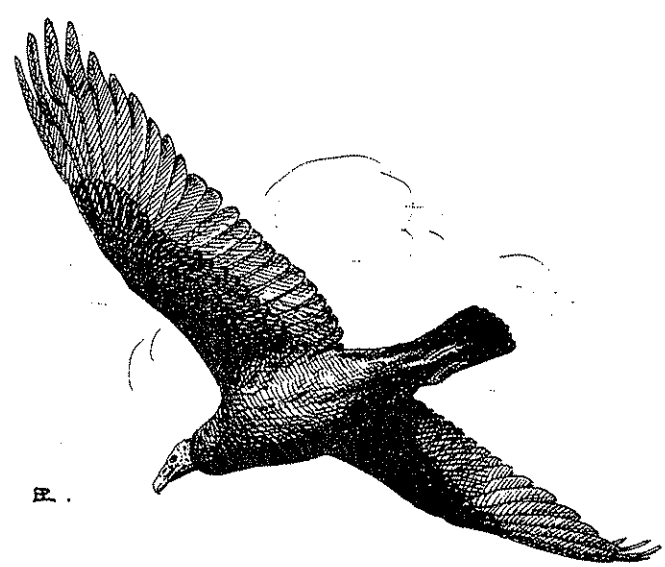
Black Vultures, mainly southern birds, are relatively new arrivals along most sections of the raptor corridor. They rarely were seen prior to the early 1970s. Today, small numbers appear annually as autumn migrants at the eastern Pennsylvania hawk migration lookouts.

Turkey Vulture (*Cathartes aura*)

Turkey Vultures are common, widely distributed birds along the raptor corridor. They are large, brownish birds (black at a distance) with five feet wingspreads and a distinctive type of tipping and tilting soaring flight. Sometimes, they engage in thermal soaring and circle high into the sky riding on a rising bubble of wam air.

Turkey Vulture nests have been found among various boulder outcroppings along the Kittatinny Ridge, and doubtless they also nest in woodlands and other habitats within the corridor.





Black Vulture (left) and Turkey Vulture (right). Drawings by Earl L. Poole.

No nest as such as constructed. Two large eggs generally are deposited upon the ground, on leaves among boulders or in caves, on some rotten wood in an old stump, or even high overhead in a tree cavity. Incubation is estimated at 30 to 41 days, with both parents sharing the duty.

The Turkey Vulture's food finding technique consists of using keen eyesight and a very highly developed sense of smell. As scavengers, they consume freshly killed animals along roads and elsewhere, and thus serve as natural garbage collectors.

Turkey Vultures are seen in the raptor corridor around-the-year, except during the coldest periods of winter. During summer, it is common to see them soaring over farm fields. The birds also roost in considerable numbers, sometimes as many as several dozen or more, in trees or on powerline towers. However, during the autumn migration season (September to November), a slow and difficult-to-detect southward migratory movement of these birds occurrs over a period of days and weeks as shown by migration studies at Bake Oven Knob, Pa.

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Wildlife Bulletin No. 5

The Kittatinny Raptor Corridor Project

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Wildlife Information Center, Inc.
Allentown, Pa.

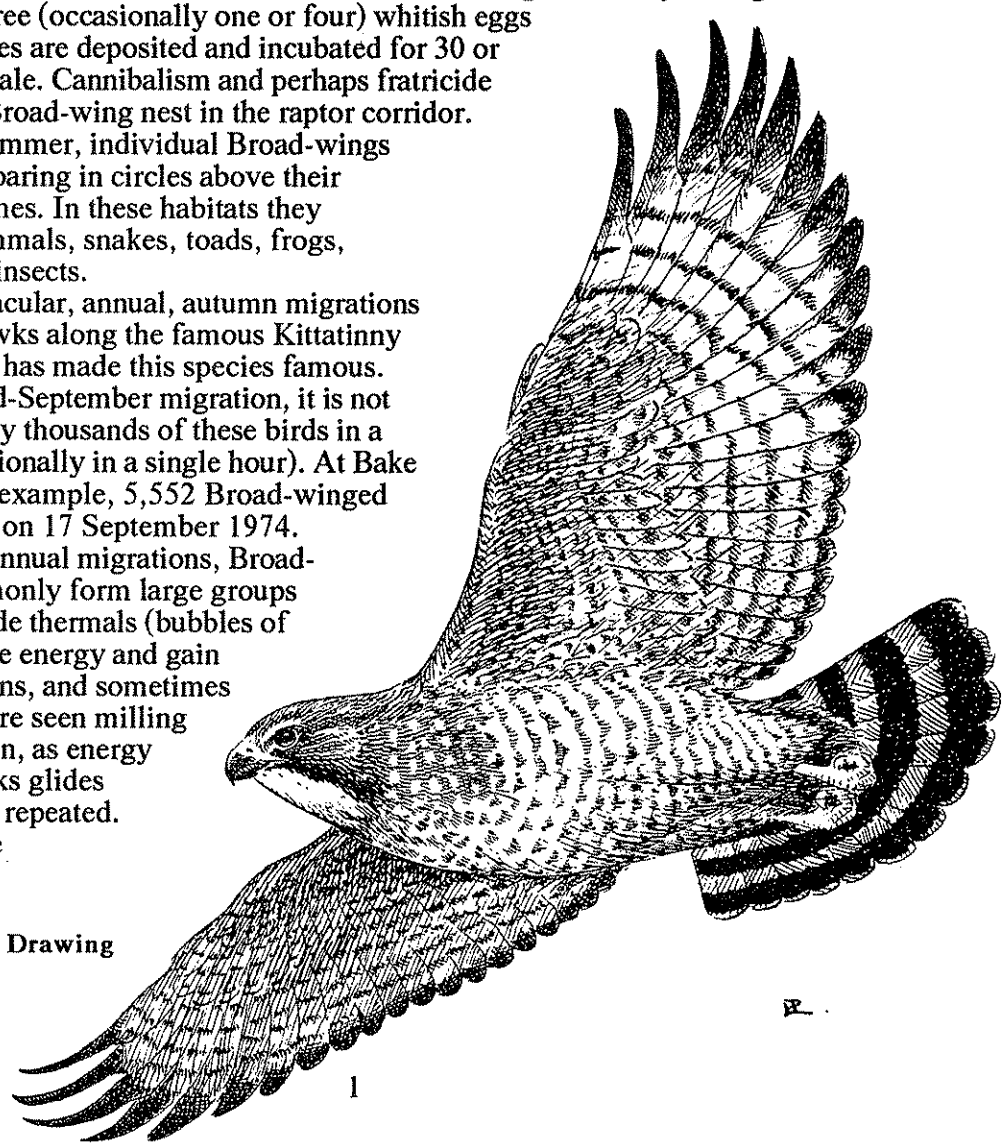
Broad-winged Hawks In The Kittatinny Raptor Corridor

Broad-winged Hawks (*Buteo platypterus*) are small, woodland soaring hawks. They are abundant autumn, and common spring, migrants along the Kittatinny Ridge. They typically nest within the raptor corridor on deciduous forest slopes, or in woodlots at the base of the ridge.

Their nest is a stick platform, lined with bark chips and green sprigs, placed on a large branch or in the main crotch of a tree as high as 90 feet above the ground. Sometimes old hawk or crow nests are selected and rebuilt for use, but Broad-wings annually change nest sites and territories. Two or three (occasionally one or four) whitish eggs with brownish blotches are deposited and incubated for 30 or more days by the female. Cannibalism and perhaps fratricide was reported at one Broad-wing nest in the raptor corridor. During season and summer, individual Broad-wings sometimes are seen soaring in circles above their forest or woodlot homes. In these habitats they prey upon small mammals, snakes, toads, frogs, and sometimes large insects.

It is the spectacular, annual, autumn migrations of Broad-winged Hawks along the famous Kittatinny Ridge, however, that has made this species famous. At the peak of the mid-September migration, it is not unusual to count many thousands of these birds in a single day (and occasionally in a single hour). At Bake Oven Knob, Pa., for example, 5,552 Broad-winged Hawks were counted on 17 September 1974.

During their annual migrations, Broad-winged Hawks commonly form large groups (called kettles) and ride thermals (bubbles of warm air) aloft to save energy and gain elevation. Often dozens, and sometimes hundreds, of hawks are seen milling within a thermal. Then, as energy is lost, a line of hawks glides away and the process repeated. Broad-wings also use deflective updrafts.



Broad-winged Hawk. Drawing by Earl L. Poole

There is considerable variation in annual autumn counts of migrating Broad-wings seen passing sites such as Bake Oven Knob, Pa. These variations are due to interacting factors including annual changes in hawk populations, varying daily weather conditions, altitudes at which hawks are flying (during mid-day it sometimes becomes extremely difficult to see raptors passing very high overhead), and differences in visual acuity of observers.

These great migratory flights of Broad-winged Hawks are birds heading southward from northern breeding grounds in the United States and Canada to wintering grounds in Central and South America. On their return spring flight, however, Broad-wings use different routes, tend to disperse over a broader migration front, and also pass across the ridge at fairly high altitudes.

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Allentown, Pa.

Some Waterfowl Of The Kittatinny Raptor Corridor

The Kittatinny raptor corridor is an important migration route for many species of birds in addition to birds of prey. Numerous waterfowl species, for example, also migrate across or along the ridge and corridor, and use the area's rivers, creeks, and other wetlands. This bulletin provides brief information about some of the corridor's waterfowl sometimes seen by ecotourists.

Canada Goose (*Branta canadensis*)

Canada Geese are common, and sometimes abundant, spring and autumn migrants. During October, for example, thousands of these birds sometimes pass across the ridge and are seen from various hawk watching lookouts in a single day. In one study conducted every autumn from 1962 through 1975 at Bake Oven Knob, Pa., records were kept of the number of flocks of geese, and number of individual geese in each flock, that passed the Knob. There were 43,595 geese counted in 759 flocks, with an average of 57.4 birds per flock. The smallest number seen was one or two birds. Occasionally a very large flock contained 500 geese.

Generally, high altitude Canada Geese migrants are birds moving southward from far northern breeding grounds. When local Canada Geese are seen, they usually pass overhead at much lower altitudes. During autumn, it is becoming increasingly common on many farms along the Kittatinny raptor corridor to see dozens, and sometimes hundreds, of these local geese feeding among corn stalk stubble on waste corn after the corn crop has been harvested. In some locations, hundreds of geese engage in daily migratory movements between waterfowl ponds and lakes in urban areas and relatively nearby corn fields in rural areas.

After overwintering at various suitable farm areas along the corridor, some of these local Canada Geese also find suitable nesting sites and breed. The nest, usually lined with grasses, reeds, sticks, and other available natural items, generally is placed on the ground, or upon a low support structure such as a stump or muskrat house, in close proximity to water. The creamy or dirty white eggs, from 4 to 10 in number, are brooded by the female for 28 days. One brood is raised per year. The result is the establishment of more or less local, resident Canada Geese populations in various sections of the raptor corridor.

Mallard (*Anas platyrhynchos*)

Mallards are common resident wild ducks observed along the Kittatinny raptor corridor, especially on farm and other small ponds and other wetlands, and along many of the area's streams, creeks, and rivers. They hide their nest, lined with down, in alfalfa fields, tall grasses, or reeds as well as in locations in close proximity to human habitation. There are 8 to 12 light greenish, grayish, or white eggs which hatch in about 26 days after being incubated by the female. It is not uncommon for Mallards to cross-breed with domestic ducks, which produces an almost endless assortment of color and plumage variations. These ducks are among the most common waterfowl seen by ecotourists in the Kittatinny raptor corridor.

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The Kittatinny Raptor Corridor Project
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Dealing With Black Bear Encounters In The Kittatinny Raptor Corridor

The Black Bear (*Ursus americanus*) is the largest carnivore normally found along the Kittatinny raptor corridor. Generally, encounters with bears that result in harm to people are rare, but excercising caution is advised. Black Bears also can become habituated when fed human food. Habituated bears can become problems -- even dangerous. Nevertheless, from 1900 through 1980, only 500 people have been injured by Black Bears across all of North America. More than 90% of the injuries were minor, but 35 injuries were major including 23 human deaths. Records pertaining to 20 of those human deaths show that 50% were people age 18 or younger, and 5 were younger than 10 years. Therefore, limited available evidence suggests that young people may be more subceptible to fatal Black Bear attacks than older people. The reason for this is unknown.

GENERAL PRECAUTIONS

Based upon the best available information, the following general precautions and suggestions **may** help avoid close Black Bear encounters or unprovoked attacks when traveling on foot, or living outdoors, in bear country along the Kittatinny raptor corridor.

1. NEVER throw away food scraps, including apple cores or banana peels, or allow human food to remain on the ground or along trails.

2. NEVER establish bear feeding stations near human habitation! Doing so invites bears to become habituated to food handouts, concentrate around dwellings, and perhaps cause problems, house damage, and injury to people.

3. Be aware and alert that you are walking in bear country.

4. NEVER attempt to feed a bear if one appears at close range!

5. Do not throw stones or other objects at a bear!

BLACK BEAR ENCOUNTERS AT DISTANCES GREATER THAN 300 FEET

If you see a Black Bear at a distance of 300 feet or more, try to maintain that distance. Do not panic. Attempt to use some or all of the following options.

1. Try to detour around the bear, and maintain a good distance from it.

2. From a safe distance, wait until the animal leaves the area and enjoy your good fortune in seeing it. However, keep in mind that the animal may have bedded down close to the trail and therefore is still near you.

3. If the animal seems to have left the area, return making plenty of loud noise and remaining fully alert. Loud noise may cause the bear to move off.

4. If, for any reason, you still believe the bear is in the vicinity and poses a threat cancel your visit and leave the area. Although it is rarely necessary to do this, ignore foolish ridicule from other people.

UNEXPECTED BLACK BEAR ENCOUNTERS AT DISTANCES LESS THAN 300 FEET

If unexpectedly encountering a Black Bear at a close distance (less than 300 feet), care should be taken because each bear may react differently -- although most will run away immediately. If not, some bear experts recommend the following actions:

1. Do NOT run; the bear likely will chase you. It can run faster than you can! If the bear rears onto its hind legs, it is trying to investigate and decide what to do.

2. Immediately, WITHOUT SUDDEN MOTION, look for a tree to climb at least 12 feet above the ground. While retreating to the tree, drop something interesting from your pack to briefly distract the bear. If you climb the tree, remain there at least 30 minutes after the bear has left. Bears are patient and cagey animals, however, and they also are excellent climbers.

3. If the bear seems uninterested, and has not acted aggressively, slowly back away while talking softly and waving your arms. DO NOT STARE AT THE ANIMAL.

4. If actually under attack, PLAY DEAD. Drop to the ground, roll up in a ball, and cover the back of your neck with your hands. DO NOT YELL OR STRUGGLE, even if the bear sniffs or paws you.

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The Kittatinny Raptor Corridor Project
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Northern Goshawks in the Kittatinny-Shawangunk Raptor Corridor

There are three species of woodland hawks in the genus *Accipiter* that occur as migrants, and sometimes breeding birds, in the Kittatinny-Shawangunk raptor corridor. The Northern Goshawk (*Accipiter gentilis*) is the largest and rarest of the three. Intermediate in size is the Cooper's Hawk (*Accipiter cooperii*), also not a particularly common raptor corridor bird. Finally, the Sharp-shinned Hawk (*Accipiter striatus*) is the smallest, and most common, of the three accipiters. This bulletin provides information about the Northern Goshawk.

Adult Northern Goshawks are large, gray hawks with a conspicuous white stripe above each eye. Robust and powerful, they usually nest in forests north of the Kittatinny-Shawangunk raptor corridor. In recent years, however, a few pairs also have nested along the extreme northern edge of the corridor in Pennsylvania.

Their nest is a large, stick platform placed high in a tree, sometimes used for several years in succession. They generally select extensive forest and woodland areas as nest sites. Usually 3 dirty white or pale bluish eggs are deposited and incubated for 36 to 38 days.

These large hawks are woodland, bird-eating raptors. Much of their food consists of large and medium-size birds, and mammals of similar size. In a classic study done by Heinz Meng, in New York and Pennsylvania, American Crows and Red Squirrels were very important food items although other species also were captured in smaller numbers.

Northern Goshawk populations tend to exhibit cyclical peaks every 10 to 12 years, but there also may be a much longer cycle in operation -- perhaps as long as every 50 years -- as suggested by long-term autumn migration counts at Bake Oven Knob (see graph) and Hawk Mountain. In 1972, for example, large numbers of Northern Goshawks were counted at both lookouts and at many other eastern and mid-western United States hawk migration lookouts. No similarly high migration counts have been seen since then along the Kittatinny-Shawangunk raptor corridor. Perhaps another cyclical high will occur before the end of this century.

Adult Northern Goshawk. Drawing by Earl L. Poole.

Northern Goshawks generally are seen late in the season (November) at hawk migration lookouts such as Raccoon Ridge, N. J., and Bake Oven Knob, Bear Rocks, Hawk Mountain, Little Gap, and Waggoner's Gap in Pennsylvania.

Earlier in this century, numerous Northern Goshawks were shot for bounty payments. In 1927-1928, near Drehersville, Pa., for example, so many Northern Goshawks were shot at what is now Hawk Mountain Sanctuary, that ornithologist George Miksch Sutton visited the site to find out why so many hawks where shot there. He found a major hawk migration observation (and shooting, prior to 1934) site on the Kittatinny-Shawangunk raptor corridor. Later, conservationists Henry H. Collins and Richard H. Pough visited the location, took photographs of dead hawks, and wrote articles which stimulated conservationist Rosalie Edge in 1934 to establish Hawk Mountain Sanctuary -- the world's first refuge for birds of prey. Today, Northern Goshawks and other raptors are protected because their ecological roles are better understood.

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Cooper's Hawks in the Kittatinny-Shawangunk Raptor Corridor

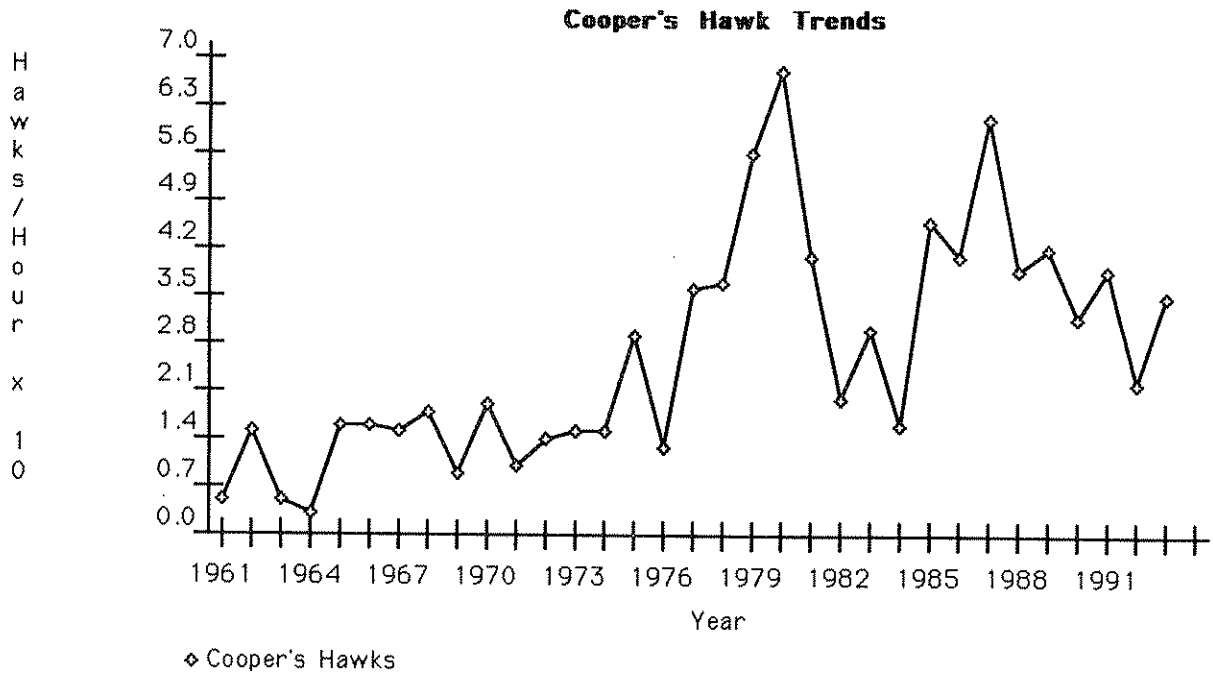
The Cooper's Hawk (*Accipiter cooperii*) is intermediate-in-size among the three accipiters that occur in the Kittatinny-Shawangunk raptor corridor. Although more common than the larger Northern Goshawk, they still are not particularly common raptor corridor birds.

Cooper's Hawks nest in the Kittatinny-Shawangunk raptor corridor in large woodlots and woodlands. Their nest is a large structure made of twigs placed on a tree limb near the trunk, or in the tree's crotch. The nest is lined with hemlock, maple, or oak bark. Generally there are 4 or 5 pale sky blue or dirty white eggs deposited, which are incubated for 35 to 36 days.

The diet of Cooper's Hawk in New York was very carefully studied by Heinz Meng who discovered that prey consists largely of medium-size birds such as European Starlings, Common Flickers, and Eastern Meadowlarks, plus small mammals such as Red Squirrels and Eastern Chipmunks. Sometimes lizards, amphibians, and large insects also are captured and eaten.

Cooper's Hawks are seen during most of the autumn hawk migration season, but October is the month when the largest numbers of these birds are migrating. They are among the most difficult-to-identify of the migratory raptors seen in the corridor. One key Cooper's Hawk field mark is its long tail, generally with a well-rounded tip. Like all the accipiters, its flight style consists of a series of flaps and glides -- but slower than that seen in migrating Sharp-shinned Hawks, and somewhat more rapid than used by Northern Goshawks. The flight also tends to be more direct than that of the Sharpie.

Adult Cooper's Hawk.
Drawing by Earl L. Poole.



The numbers of migrating Cooper's Hawks counted at autumn hawk migration lookouts such as Bake Oven Knob, Pa., vary considerably from year to year (see graph). Perhaps 10- or 12-year population cycles are reflected in the migration counts. However, it will be well into the next century before enough annual autumn hawk count data are gathered to confirm or reject that idea.

Meanwhile, during winter, Cooper's Hawks sometimes discover concentrations of birds at backyard bird feeders. Raptors are exhibiting normal behavior by capturing such vulnerable prey. Hence, people can learn about predation ecology when they see a Cooper's Hawk capturing and eating a small bird at a backyard feeding station.

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Wildlife Bulletin No. 10

The Kittatinny Raptor Corridor Project

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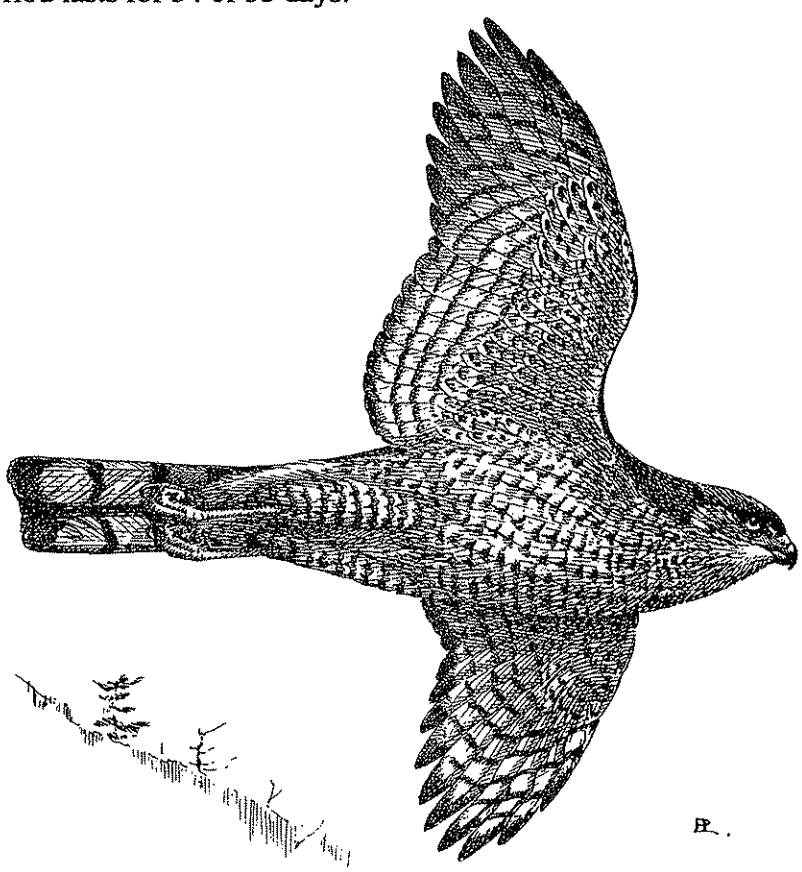
Wildlife Information Center, Inc.
Allentown, Pa.

Sharp-shinned Hawks in the Kittatinny-Shawangunk Raptor Corridor

The Sharp-shinned Hawk (*Accipiter striatus*) is smallest of the three accipiters that occur in some unfragmented forests and woodland of the Kittatinny-Shawangunk raptor corridor. They are the second most abundant autumn raptor migrants along the raptor corridor.

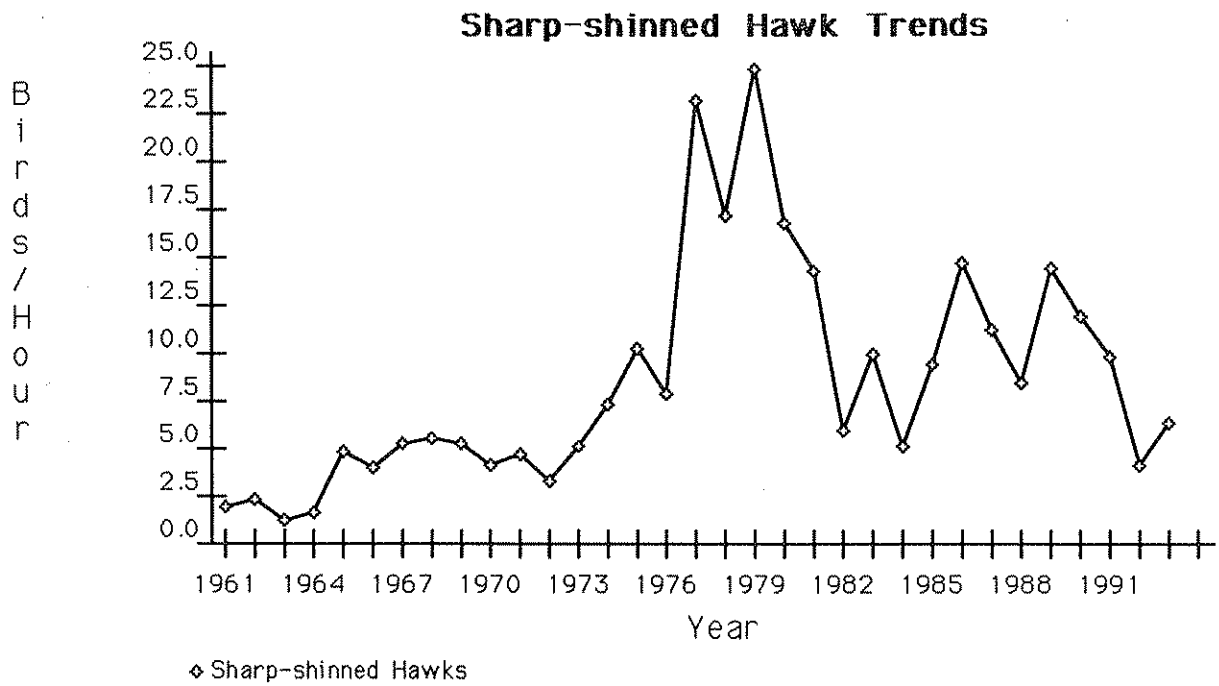
Small numbers of Sharp-shinned Hawks also nest in remote woodlands in the corridor. The nest consists of a large platform of twigs, generally placed on a conifer branch but occasionally in oak trees. Various items -- mostly twigs, strips, or chips of bark -- line the inside of the nest. There are 4 or 5 eggs, white or bluish-white in color, with brown and/or purple marks. The incubation period lasts for 34 or 35 days.



Adult Sharp-shinned Hawk migrating along the Kittatinny Ridge. Drawing by Earl L. Poole.

Sharp-shinned Hawks are predators on small birds, but small mammals, lizards, and insects also are taken. During the autumn migrations, as Sharpies fly above forested slopes of the Kittatinny-Shawangunk Ridge, hawk watchers sometimes see these hawks plunging into the forest below in an effort to capture a bird. Sometimes these efforts are successful, but many times the intended prey escapes.

There is great yearly variation in the numbers (expressed as a rate of passage) of Sharp-shinned Hawks counted at Bake Oven Knob (see graph) and other Kittatinny-Shawangunk Ridge autumn hawk migration lookouts.



Autumn migrations of Sharp-shins at Atlantic coast concentration areas, such as Cape May Point, N. J., contain mostly immatures, whereas autumn Sharp-shin flights along the inland Appalachian mountains, such as the Kittatinny-Shawangunk Ridge, contain both adult and immature birds. To date, however, Sharp-shinned Hawk age ratio data from Bake Oven Knob do not confirm the claim by Cape May Point raptor biologists that this species is experiencing a major reproductive failure on its eastern North American breeding grounds. However, hawk migration experts from the Wildlife Information Center are continuing to monitor Sharp-shin age ratios during the Center's annual autumn Bake Oven Knob Hawk Watch.

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Owls of the Kittatinny-Shawangunk Raptor Corridor

Owls that live in the Kittatinny-Shawangunk raptor corridor are the topic of this bulletin. They are mostly nocturnal predatory birds, although a few are active during daylight hours. The predatory behavior of owls compliments that of hawks, eagles, falcons, etc., which are diurnal raptors. All owls and other birds of prey are protected by federal and state laws.

Common Barn Owl (Tyto alba)

These white or tawny owls with a heart-shaped face and brown eyes range from 14 to 20 inches in length and have a wingspread ranging from 43 to 47 inches. They make loud hisses, shrill screeches, and other strange noises. They are birds of open country, agricultural areas, and urban developments. They do not construct their own nest, rather laying 5 to 7 white eggs in silos, towers, holes in trees, large bird boxes (such as the Wildlife Information Center is placing at some locations in the raptor corridor), and similar sites. The food of Common Barn Owls consists of rats and mice, with other items taken occasionally, which makes then valuable birds to have living on a farm. Some Barn Owls are migratory.

Eastern Screech Owl (Otus asio)

The Eastern Screech Owl, found in red or gray color phases, is common along the raptor corridor. It is one of the tufted or "eared" owls whose larger relatives include Long-eared and Great Horned Owls. Screech Owls have yellow eyes with black pupils, range in size between 8.3 and 8.9 inches in length, and have a wingspread ranging between 20.1 and 22.6 inches. They are found in open country, often near creeks and river, and in rural as well as suburban and urban areas. The 4 or 5 white eggs are deposited in a cavity of an old tree, bird boxes (such as the Wildlife Information Center is placing at some locations in the raptor corridor), hollow stumps, openings in buildings, and other sheltered places. Despite their small size, Screech Owls are fierce predators which feed on *Microtus* voles, other small rodents, small birds, amphibians and reptiles, fish, and other invertebrates. Sometimes berries, fruit, and other plant matter is consumed.

Great Horned Owl (Bubo virginianus)

The Great Horned Owl is the largest, most powerful owl normally found in the raptor corridor. It measures 18.4 to 25.7 inches in length, and has a wingspread measuring between 49 and 62.1 inches. A brown owl with conspicuous ear tufts or "ears," it has various other markings and is variable in color. The bright yellow eyes have black pupils. Great Horned Owls live in forests, woodland edge, woodlots, some wetlands close to woodland, and sometimes open country with some trees to support nests -- generally abandoned hawk, crow, or other stick structures, but occasionally hollows in trees, nest boxes, or openings in cliffs. The 2 or 3 white eggs are deposited early in the year, often in January or February. Food consists of medium-size mammals such as rats, rabbits, as well as birds, reptiles, amphibians, fish, and invertebrates.

Long-eared Owl (Asio otus)

Long-eared Owls are slender and "eared," intermediate in size between Screech and Great Horned Owls. They are 13 to 16.1 inches long with a wingspread between 36.3 and 43.3 inches. They are brown with streaking. Their eyes are yellow with black pupils. They often roost in a conifer or on a limb of a deciduous tree, near the trunk, and appear elongated. They prefer dense coniferous woodland, some deciduous woodland, woodlots, parks, and orchards. An old squirrel, hawk, or crow nest placed high in a tall tree provides a nest. The 4 or 5 eggs are white. Food consists of rodents, other small mammals, some birds, snakes, frogs, and insects.

Short-eared Owl (Asio flammeus)

Short-eared Owls are 13.3 to 17.1 inches in length, with a wingspread measuring 38.3 to 44.1 inches. They are brown, have small "ear" tufts (not always visible), and yellow eyes with black pupils. They prefer wetlands and fields, generally avoiding woodlands and forests although they have been seen in autumn at Bake Oven Knob atop the Kittatinny Ridge. The nest is a depression on the ground, with grasses, weeds, and feathers as lining. The 5 to 7 eggs are white or pale creamy-white. The Long-eared Owl's diet is *Microtus* voles, shrews, other small-to-medium size mammals, a few birds, and insects.

Snowy Owl (Nyctea scandiaca)

Snowy Owls are tundra birds that occasionally appear in the raptor corridor during very cold winters when arctic and sub-arctic food supplies (especially lemmings) are scarce. They measure 20.9 to 30.2 inches in length, and have a wingspread of 51.9 to 71.6 inches. These owls are spectacular white birds with large yellow eyes, and a trusting behavior allowing close approach. They are diurnal in behavior and appear in open fields, pastures, wetlands, and urban areas. They do not nest in the Kittatinny-Shawangunk raptor corridor. Their food is small and medium size mammals and birds. When a Snowy Owl appears in the raptor corridor, efforts should be made to see and observe these birds which are among the most beautiful and fascinating of all owls. Earlier in this century, hunters shot Snowy Owls which happened to appear in the raptor corridor. It is illegal to do so now because all birds of prey are legally protected.

Barred Owl (Strix varia)

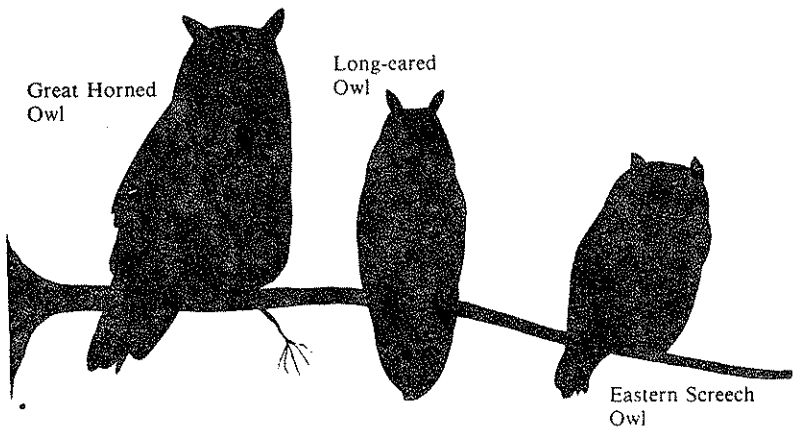
Barred Owls are large, round-headed brown birds, have a barred breast, streaked belly, lack "ear" tufts, and *brown* eyes. They measure 16.1 to 24.2 inches in length, and have a wingspread of 38 to 50 inches. They prefer wet or swampy woodland, but hunt over farmland, open country, and sometimes in villages, towns, and even cities. They often make their nest in an old raptor (especially Red-shouldered Hawk) or crow nest, or in deep tree hollows. The 2 or 3 eggs are white. Food is small and medium-size mammals and birds, plus some reptiles, amphibians, fish, and insects. Barred Owls are the nocturnal counterparts of Red-shouldered Hawks, and both species tend to occupy similar habitats.

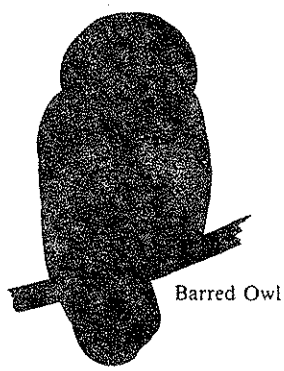
Northern Saw-whet Owl (Aegolius acadicus)

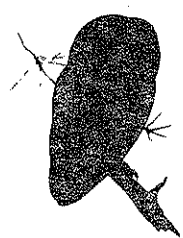
The Northern Saw-whet Owl is the smallest owl found in the Kittatinny-Shawangunk raptor corridor. It is a brown bird without "ear" tufts, and has yellow eyes with black pupils. They measure only 7.1 to 8.6 inches in length, with a wingspread of 18.1 to 22.2 inches. They occur in deciduous and coniferous woodland and forests, pine plantations, honeysuckle thickets, and wetlands. They select old flicker and other woodpecker holes, or rarely boxes, as nest sites. The 5 or 6 eggs are white. Food consists of shrews, small rodents, bats, small birds, and insects. Northern Saw-whet owls are very difficult to see when perched amid pine branches or in a honeysuckle thicket, but are exceptionally "tame" when discovered. They are among the most fascinating owls found in the raptor corridor. Unfortunately, some of these birds tend to hunt along highways and are hit and killed by passing vehicles as they dart after prey ahead of automobiles and trucks.

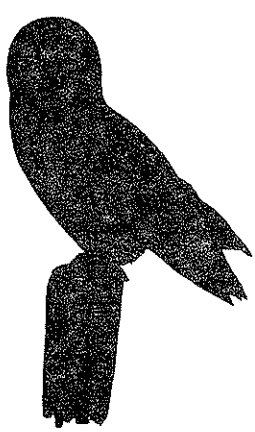
Owl Silhouettes of the Kittatinny-Shawangunk Raptor Corridor

(Silhouettes by Rod Arbogast)









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Owl Study Methods

Owls provide teachers and students with excellent field and laboratory study opportunities. Diurnal species, such as Short-eared and rarely Snowy Owls, sometimes are observed relatively easily while perched or hunting over fields and meadows, or in wetlands. Nocturnal species (most owls) also can be observed, and sometimes heard, if special efforts and methods are used. Some species, such as Eastern Screech and Great Horned Owls, give a vocal response to an in-the-field playback of a tape recording of their voices. Some birds fly close to the source of the recording, giving observers excellent but brief opportunities to see the birds. **Never play tape recordings of owl voices for long periods of time, in the same location, to avoid disruption or abandonment of owl nest territories.**

Owls also can be found by *quietly* walking through stands of pine or other coniferous trees looking for "whitewash" streaked down tree trunks and birds perched among the branches. Species typically found at roosts are Common Barn, Long-eared, Short-eared, and Northern Saw-whet Owls. If an active roost is discovered, observe the birds quietly -- then leave the area to prevent the birds from being disturbed.

Raptor biologists also "read sign" when conducting owl field studies. In addition to looking for "whitewash," they look for feathers or other prey remains, and pellets which owls eject through their mouth. Pellets contain skulls, bones, feathers, and other parts of prey that were not digested. By carefully picking pellets apart, and studying their contents (especially skulls of small mammals), it is possible to determine owl diets. Studying owl pellets gives teachers and students an excellent classroom follow-up to an owl watching field trip.

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Large Extinct Mammals Formerly Found in the Kittatinny-Shawangunk Raptor Corridor

This bulletin discusses extinct mammals formerly found in the Kittatinny-Shawangunk raptor corridor, and some considerations regarding possible reintroductions of these species.

Previous efforts to reintroduce Elk to the Pocono Mountains failed, but with increased knowledge about ungulate biology and ecology, new attempts might be worthwhile. Interest exists regarding reintroduction of Elk to the Pocono Mountains north of the raptor corridor.

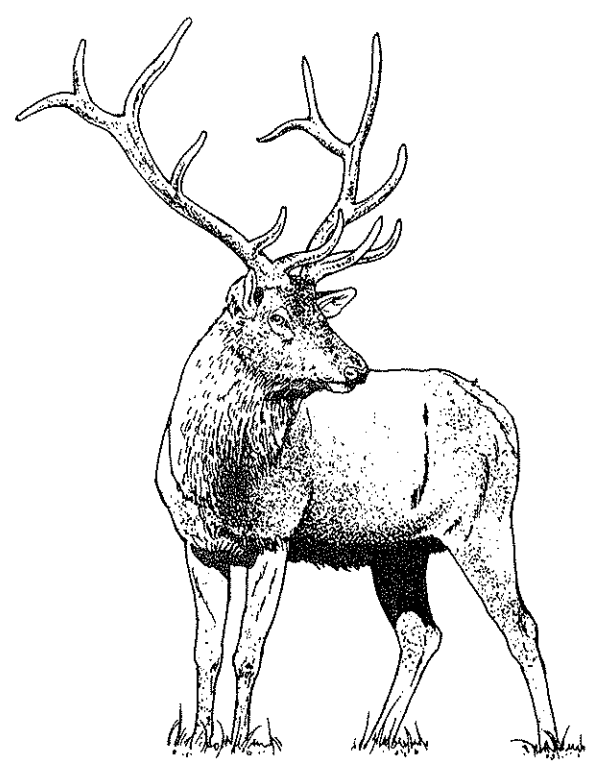
Reintroducing large predators into remote parts of the raptor corridor would present major problems. In the 18th and 19th centuries, predators were considered threats to human survival and economic interests. They were killed, sometimes for bounty payments. Modern attitudes have changed regarding the ecological importance of predators, there is interest among conservation biologists regarding restoration of missing links in food chains, food webs, and wildlife communities, and an adequate White-tailed Deer prey base exists. However, large predators such as Mountain Lions and Gray Wolves need very large areas relatively free from human occupation. Hence, restoration probably is not possible for these two species. However, Black Bears already are venturing into the Pennsylvania section of the raptor corridor with increasing frequency.

Elk or Wapiti (Cervus canadensis)

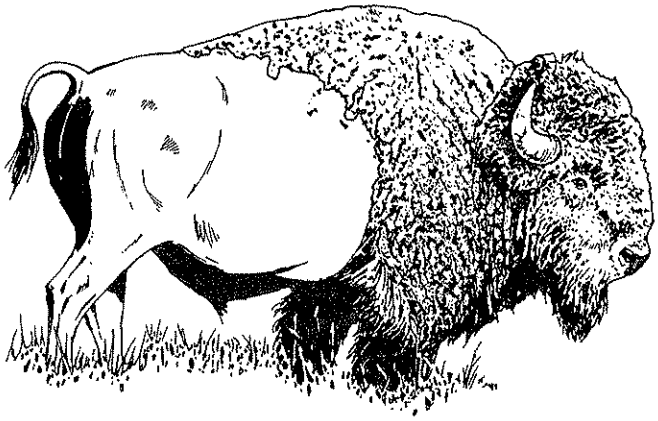
Formerly rare along the Kittatinny Ridge. The last Elk in Monroe and Pike Counties were shot between 1840 and 1845. A small herd of about 200 Elk exists in western Pennsylvania, and another small captive herd lives in the Trexler-Lehigh County Game Preserve near Schnecksville, Pa., a few miles south of the raptor corridor.

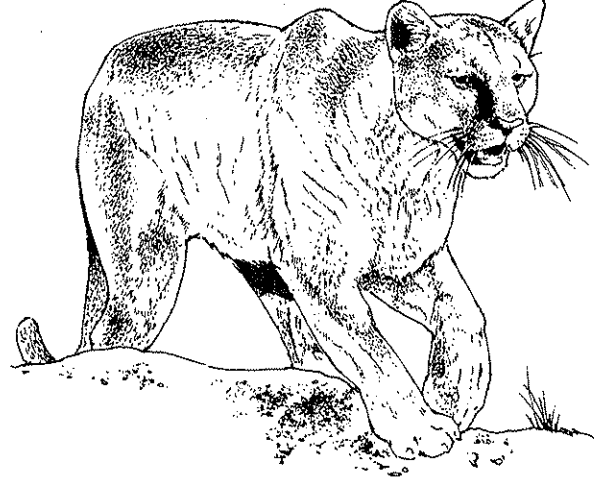
Bison (Bison bison)

Bison bone and teeth were found in a cave near Stroudsburg, suggesting food use by American Indians. The last wild Bison was killed in 1801 in Union County, Pa. However, Bison live at the Trexler-Lehigh County Game Preserve near Schnecksville, Pa.



Elk or Wapiti. Drawings by Bob Giuliana.





Bison (left) and Mountain Lion (right). Drawings by Bob Giuliana.

Gray Wolf (Canis lupus)

In pre-colonial Pennsylvania, Gray Wolves were important predators on White-tailed Deer. They were exterminated along the Kittatinny Ridge in the mid-1850s.

Mountain Lion (Felis concolor)

Mountain Lions became extinct in Pennsylvania about 1871, after having bounties paid on them for decades. Recent claims that Mountain Lions exist in Pennsylvania are not verified.

Fisher (Martes pennanti)

Fishers once lived on the Kittatinny Ridge in Pennsylvania. John James Audubon's 1844 painting was of two from Peter's Mountain near Harrisburg. In 1877, Perry County residents noted Fishers on the ridge. A 1983 checklist for the northern Shawangunk Mountains in Ulster County, N. Y., states that Fishers were reintroduced in 1976 but remain rare.

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In the raptor corridor, American Kestrels feed on small mammals such as *Microtus* voles, Meadow Jumping Mice, and Short-tailed Shrews. Eastern Meadowlarks, Common Grackles, Brown-headed Cowbirds, Cardinals, and Grasshopper Sparrows also are eaten, as are grasshoppers, Periodical Cicadas (when these insects are present), dragonflies, and beetles.

Utility poles and wires on high hills are important perches allowing migrating kestrels to hunt, feed, and rest. When poles and wires are removed, fewer falcons use the hilltops.

During autumn, migrating American Kestrels at Bake Oven Knob, Pa. exhibit 10- to 12-year population cycles (see graph) which might be linked with *Microtus* cycles.

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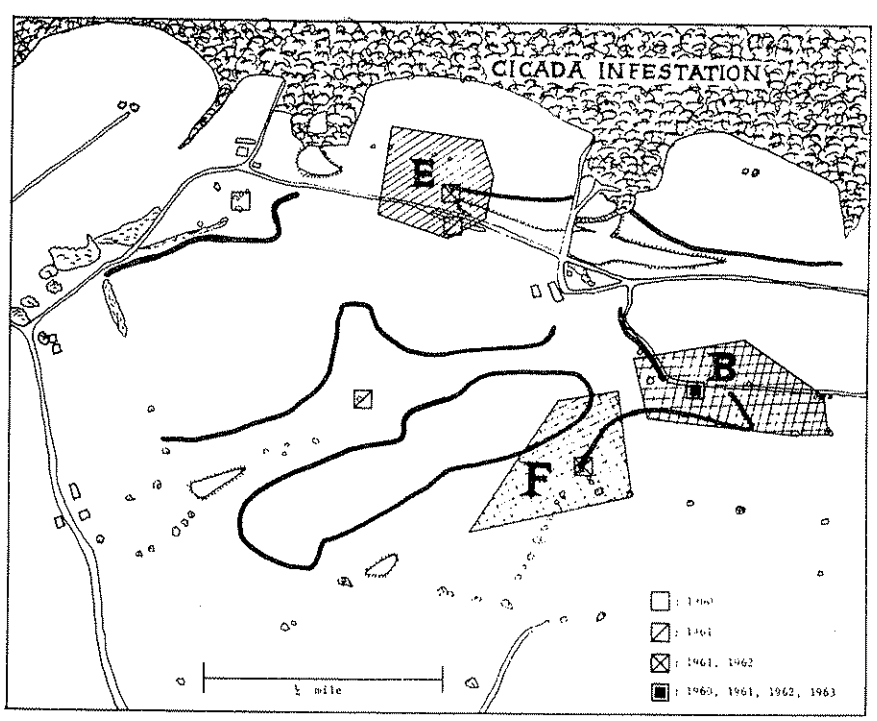
The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

American Kestrels in the Kittatinny-Shawangunk Raptor Corridor

The American Kestrel (*Falco sparverius*) is the smallest, most colorful, and common of the falcons that occur regularly in the Kittatinny-Shawangunk raptor corridor. They are open-field-oriented falcons that typically are found in agricultural and other old fields. The number of American Kestrel nest territories sometimes can be high, and close to one another, as studies demonstrated in the late 1950s and early 1960s on Charlex Farm in Albany Township, Berks County, Pa. (see map). Natural tree cavities, old woodpecker holes, openings in buildings, and nest boxes provide sites in which are deposited 4 or 5 white to pinkish-white eggs covered with brownish blotches or spots. Incubation ranges from 28 to 35 days, often 31 days. Approximately 78 percent of the eggs hatch, and cleaning nest boxes does not influence egg hatchability rate.

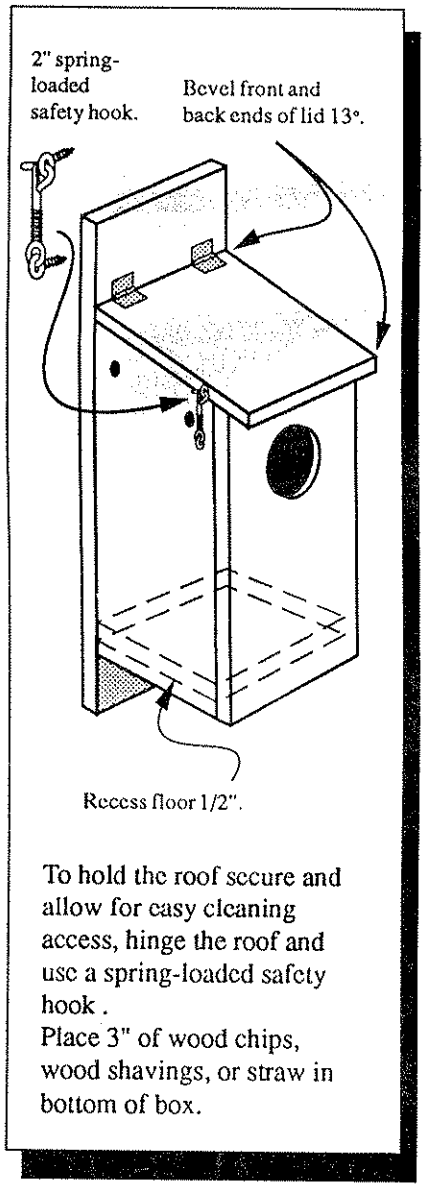


Locations of 11 American Kestrel nest sites on Charlex Farm from 1960 to 1963, and relationships of 1962 nest territories B, E, and F to a cicada infestation on the adjacent Kittatinny Ridge. In 1961, two additional nests were slightly outside the area covered by this map. Reprinted from Heintzelman (1964, *Wilson Bulletin*).

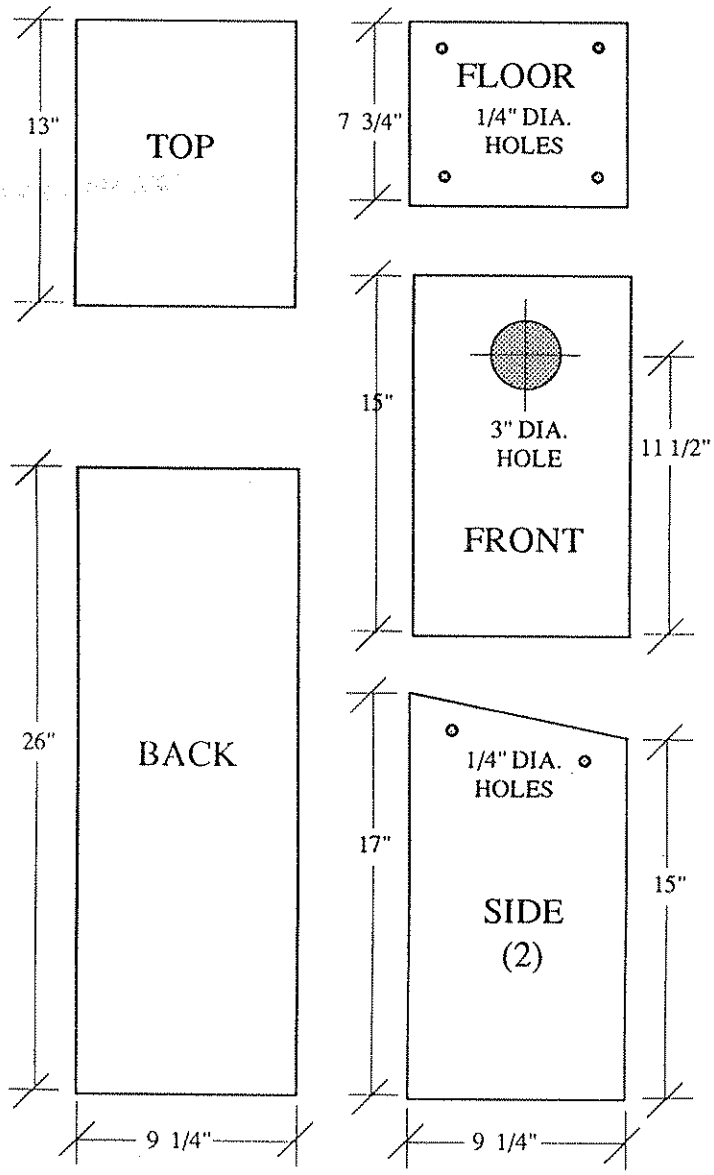
American Kestrel
(Drawing by Earl L. Poole)

American Kestrel Nest Box Design

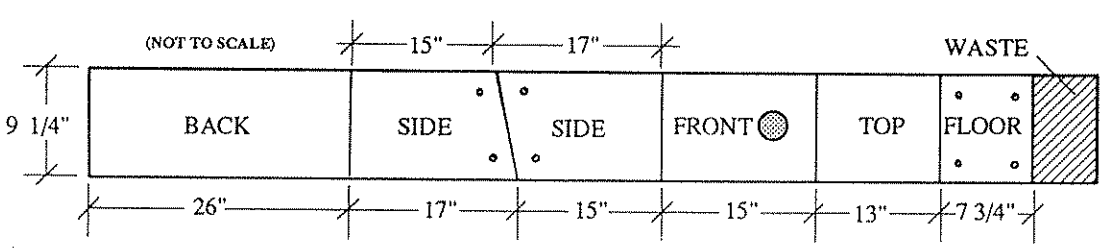
(Iowa Department of Natural Resources)



To hold the roof secure and allow for easy cleaning access, hinge the roof and use a spring-loaded safety hook.
Place 3" of wood chips, wood shavings, or straw in bottom of box.



LUMBER: One 1" x 10" x 8' 0", (#2 white pine recommend). Painting the box will increase its useful life.
HARDWARE: Twenty-two 1 1/2" wood screws (#6), two 2" hinges and one 2" spring-loaded safety hook.



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Wildlife Bulletin No. 14

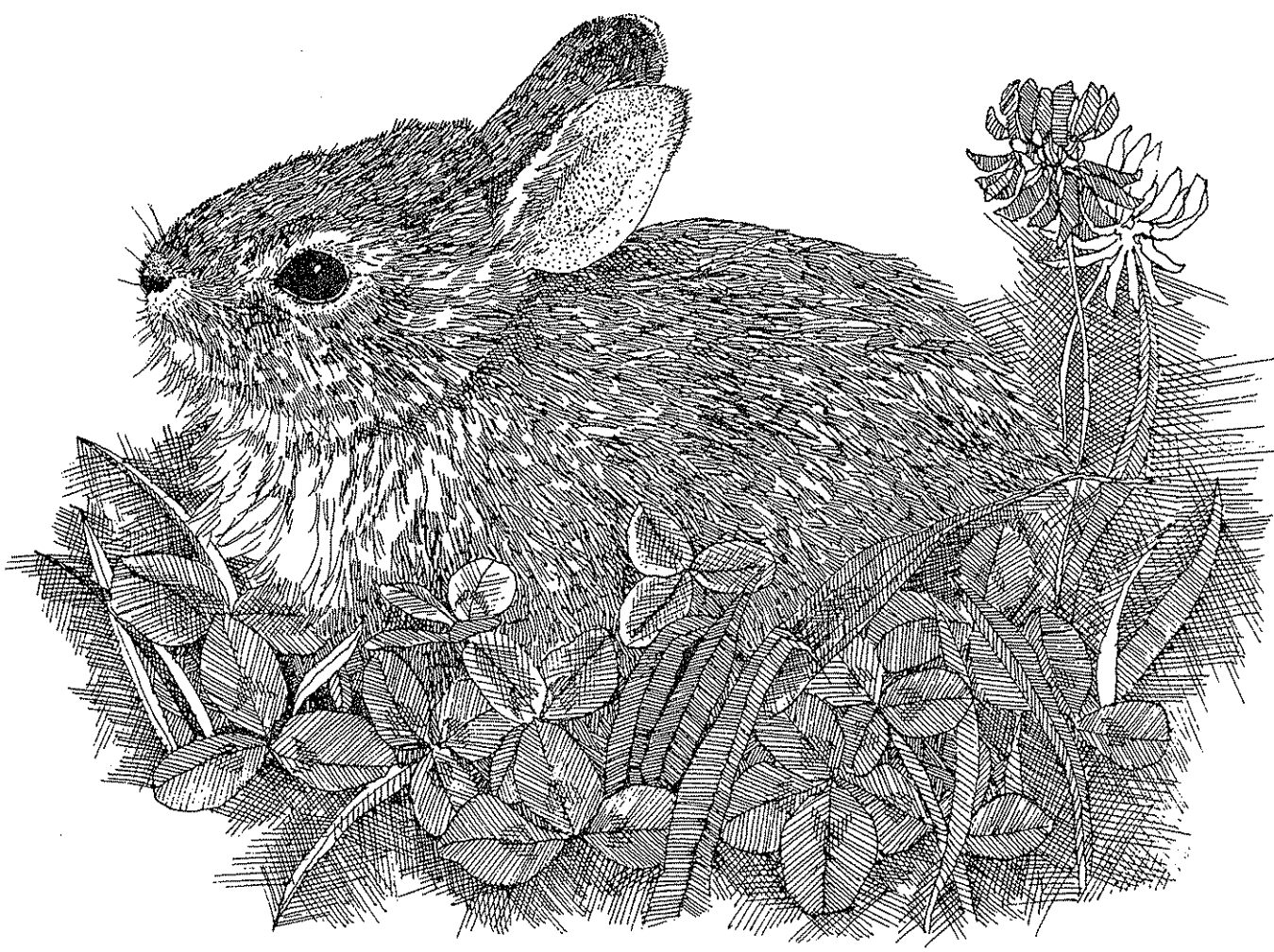
The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Slatington, Pa.

Eastern Cottontails In The Kittatinny-Shawangunk Raptor Corridor

Eastern Cottontails (*Sylvilagus floridanus*), familiar to almost everyone, are commonly found in the Kittatinny-Shawangunk raptor corridor. They measure up to 19 inches in length, weigh up to 3.3 pounds, and generally number from 3 to 5 per acre. These rabbits are brown or gray, have white underparts, a buffy throat, a distinctive rusty patch on the nape, and a white ring circling the eye. There are two annual molts. The spring molt occurs from March to August, and the autumn molt begins late in September and produces the winter pelage (not white) early in November.



Habitats occupied by Eastern Cottontails range from agricultural areas to thickets, and logged woodlands. They generally do not occur in dense forest, but they live in rural areas as well as suburban and urban parks.

Eastern Cottontails are prolific animals. After a 30 day gestation period, the year's first litters arrive in March or April, with 3 to 8, typically 5, animals in the litter. Between 5 and 7 litters are produced annually, resulting in as many as 35 young rabbits annually. The newly born rabbits are about 4 inches long, naked, and blind. They are nursed by their mother early in the morning and at dusk. The young animals open their eyes about a week after being born, and they are weaned when about 5 weeks old. After leaving the nest, they forage alone. Females from the litter can breed during their first season, but males generally do not. Wild Eastern Cottontails usually do not live longer than about 2 years.

Eastern Cottontails, juveniles in particular, experience high, natural and human-inflicted (hunting) mortality rates. Mowing and plowing activities in agricultural areas, and parks, also destroys many rabbits -- especially young in the nest. Considerable numbers of Eastern Cottontails also are killed on highways and rural roads.Finally, these mammals are preyed upon by the hawks and owls, Striped Skunks, Raccoons, Minks, foxes, weasels, snakes, and domestic dogs and cats. Eastern Cottontails also can carry tularemia, so-called "rabbit fever," which is spread by tick bites and can be transmitted to humans upon contact with sick rabbits.

The diet of Eastern Cottontails is varied. When vegetable gardens are available, rabbits prefer lettuce, cabbage, green beans, and peas. Elsewhere they feed on grasses, dandelion leaves, and herbaceous vegetation. Alfalfa and clover are preferred. In winter, the diet changes to bark of woody plants such as apple, sumac, wild black cherry, and blackberry. During hard winters, if food is difficult to obtain, rabbits can cause damage or death to shrubs and fruit trees by girdling them. When rabbit-caused girdling occurrs, large teeth marks are seen high above snow level, and bark often hangs in strips. In many cases, however, mice actually caused much of the tree damage.

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Slatington, Pa.

Small Native Mammals Of The Kittatinny Raptor Corridor

Some of the small, native mammals that live along the Kittatinny-Shawangunk Range, and/or within the raptor corridor, are the topic of this bulletin. These rodents are fascinating little animals. Many are of great ecological, and in some instances, economic importance.

White-footed Mouse (Peromyscus leucopus)

The White-footed Mouse is brownish-fawn with white fur on its undersides and, as its name suggests, has white feet. It measures up to 7.8 inches long, and weighs up to 1.1 ounces.

This common mouse is distributed in woodlands, woodlots, orchards, fence-rows, brush piles, and other locations along the Kittatinny-Shawangunk raptor corridor. Indeed, it is the most common forest mammal along the ridge. However, because it is nocturnal, it is seldom seen.

The White-foot's breeding season extends from early March to the end of October, with nests placed in trees, hollow logs, stone piles, under boards or other cover in fields, and even in deserted birds' nests. In such secure places, 3 to 5 young are born, with 3 or 4 litters produced yearly. Population densities can range from 2 to 15 per acre, peak numbers occurring during late summer and early autumn, but with winter populations gradually declining. White-footed Mice can live up to 2 years in the wild. The animals begin food hoarding in autumn, although the food habits of White-footed Mice vary seasonally. In autumn and winter, beetles, spiders, centipedes, insect larvae and pupae, and some seeds, nuts, and green matter are consumed. However, in spring and summer, seeds and fruit along with insects form the bulk of the diet.

Because the White-foot is at the base of predator food chains, it is an important prey item in the diets of Raccoons, Striped Skunks, foxes, weasels, and occasionally Short-tailed Shrews. Regretfully, in recent years this charming animal has gained notoriety because it is one of the major carriers of the tick that hosts the bacteria that causes Lyme disease.

Red-backed Vole (Clethrionomys gapperi)

The Red-backed Vole is one of the strikingly handsome rodents found along the Kittatinny-Shawangunk Range. It has black eyes, orange teeth, and a vivid reddish band extending along its back from forehead to tail. It ranges up to 2 inches in length, and weighs up to 1.3 ounces. In the wild, it can live as long as 2 years.

Red-backed Voles occur along the length of the Kittatinny Ridge, being particularly common around rocky outcroppings. In the section extending from the Pinnacle-to-Hawk Mountain-to-Bake Oven Knob, Pa., Earl L. Poole discovered a new Red-backed Vole subspecies at the Pinnalce, Albany Township, Berks County, Pa.

The breeding season for Red-backed Voles begins in late March and continues through November. A male, female, and litter occupy a nest in abandoned holes or nests of small mammals, or natural cavities. Two or 3 litters containing 4 or 5 young are produced yearly. The young animals are weaned when about 17 days old, and within 3 months reach sexual maturity.

The Red-back sometimes is seen during daylight dashing among rocks and boulders on hawk migration lookouts atop the ridge. On one field trip to Bake Oven Knob, a vole went to a teacher's cup of hot chocolate and drank the treat! Not infrequently, these voles also pop into view to eat apples or peanut butter provided by hawk watchers. When not fed by visitors on hawk migration lookouts, the Red-back's diet is omnivorous. Nuts, berries, seeds, mosses, lichens, ferns, and fungi form the vegetative portion of the diet. Few insects are eaten, but other arthropods may be consumed.

Meadow Vole (Microtus pennsylvanicus)

The Meadow Vole is a small brown rodent measuring up to 7.4 inches in length, and weighing up to 2.3 ounces. It generally is the most widespread and abundant rodent found in agricultural fields and moist meadows within the Kittatinny-Shawangunk raptor corridor. There probably is not a farm field that does not have some of these mammals living there. Populations of Meadow Voles are cyclical, with peak densities occasionally reaching as many as 270 per acre. Peaks in Meadow Vole population cycles occur every 4 years, then crash and begin the population build-up again.

Meadow Voles breed between late March and late autumn. Their grass nests are placed either in clumps of grass on the surface of a field, or 3 to 4 inches underground. Males voles are solitary, using their own nests. Breeding females are strongly territorial, but when they have young they use nests communally. One female typically produces 5 to 8 young in a litter, with as many as 8 or 9 litters produced annually. By the age of 21 days, the young have been weaned and are independent. Young Meadow Voles are sexually mature when 4 or 5 weeks old.

Because Meadow Voles are so widespread in distribution, abundant, and bridge the ecological gap between produces and consumers, they are very important prey species. A range of predators feed on Meadow Voles including foxes, weasels, Striped Skunks, Raccoons, and Opossums. Feral house cats roaming farms also prey on these rodents. Among raptors, Red-tailed Hawks, American Kestrels, and Barn Owls consume Meadows Voles in considerable numbers. Other birds including Blue Jays, American Crows, and shrikes also are known to feed on these voles. Some snakes are vole predators as well.

The diet of Meadow Voles consists largely of vegetable matter such as grasses, legumes, roots, and similar items although seeds form an important part of its diet in midsummer. Apple trees can be injured when large numbers of voles are present because they girdle the trunks of young trees. Some insects, underground fungi, and occasionally remains of animals also are consumed. As winter approaches, the voles horde food such as grasses, roots, fruits, and seeds in caches both underground and above ground.

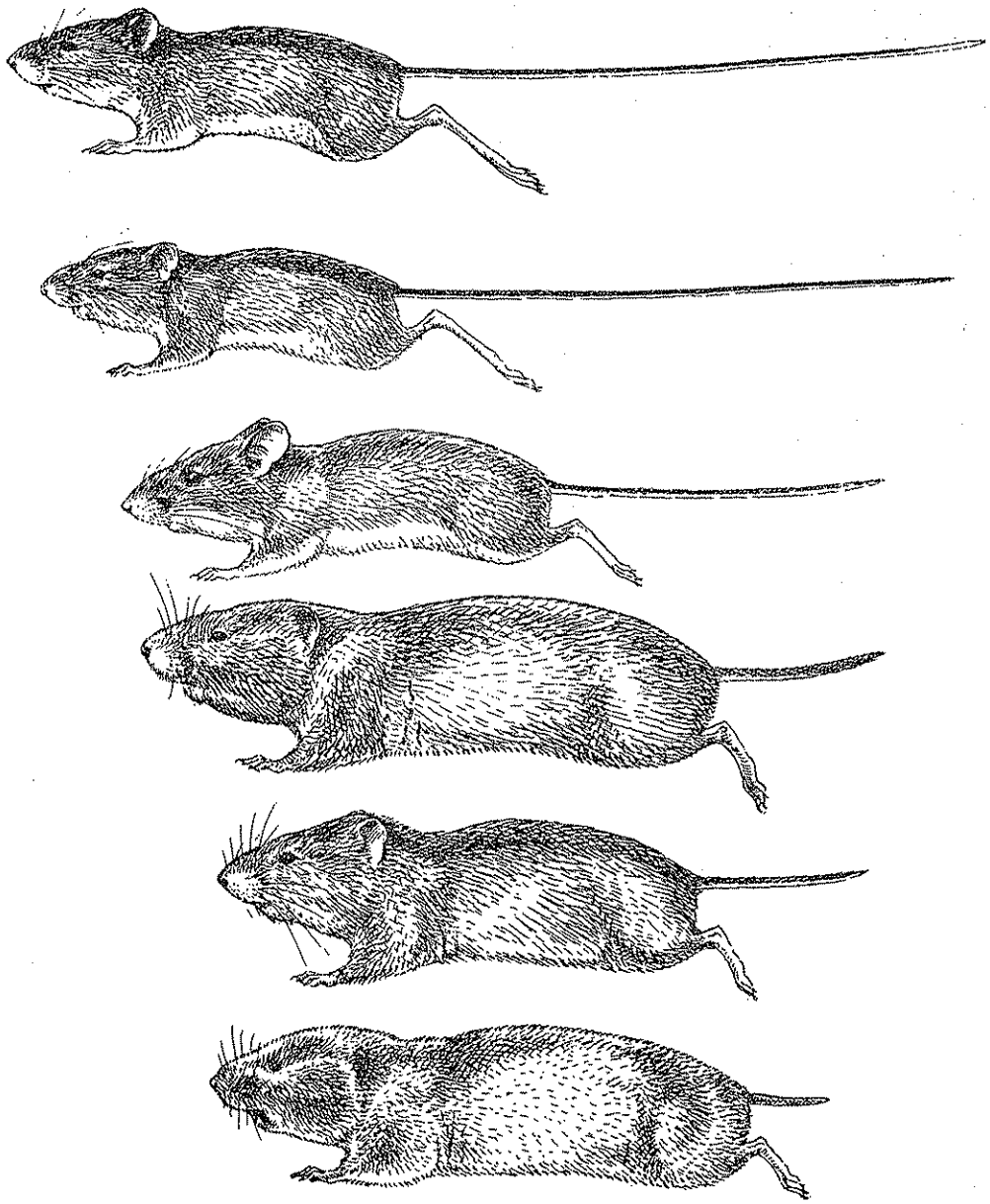
Pine Vole (Microtus pinetorum)

Pine Voles are the smallest voles found in Pennsylvania, measuring up to 5.5 inches in length, and weighing up to 1.3 ounces. They have a chestnut-brown back, and a silvery-gray belly. They sometimes live as long as 1.5 years in the wild.

These small voles live largely underground in tunnels and burrows in old fields with sandy soil, rocky hillsides along the Kittatinny Ridge, along agricultural field edges, fencerows, and in orchards and gardens. The breeding season extends from late February through late autumn. Nests are constructed of dry, shredded grasses along with leaves and roots. Four young usually form a litter, the young being weaned when they are about 3 weeks old. The young become sexually mature when they are about 2 months old. There probably are only 2 litters produced annually. Population densities can reach levels of 50 per acre, with as many as 300 per acre reported in one New York State orchard.

Although various raptors such as Great Horned Owls, Eastern Screech Owls, and Barred Owls, and predatory mammals including Opossums, foxes, Striped Skunks, Raccoons, weasels, Short-tailed Shrews, and feral house cats feed on this species, the Pine Vole's underground habits tend to lessen predation pressure that otherwise might be expected to remove considerable numbers of the animals from wild populations. However, Pine Voles suffer from infestations of lice, fleas, ticks, mites, and chiggers as well as various internal parasites.

Small Native Mammals
(Drawings by Earl L. Poole)



Small native mammals (top to bottom): Woodland Jumping Mouse, Meadow Jumping Mouse, White-footed Mouse, Meadow Vole, Red-backed Vole, and Pine Vole. Reprinted from *A Survey of The Mammals of Berks County, Pennsylvania* . 1932. Bulletin 13. Reading Public Museum and Art Gallery, Reading, Pa.

Meadow Jumping Mouse (Zapus hudsonius)

The Meadow Jumping Mouse has large hindfeet, a bright yellowish-brown coat on the upperside and white underside, and tail longer than the body length. It measures up to 5.5 inches in length. Some live as long as 2 years in the wild.

Meadow Jumping Mice make long jumps -- as far as 8 feet -- and are excellent swimmers. Generally nocturnal, some venture out during daytime to take sun baths on cool autumn mornings. During winter, beginning from late October, they engage in hibernation for as long as 6 months. During this period, their heart and respiratory rates are greatly reduced and their temperature drops to 35 to 40 F. degrees. The animals come out of hibernation in late April or early May.

Habitats include old grassy fields, thickets adjacent to streams and ponds, grain fields, and woodland edges. Breeding begins soon after the animals come out of hibernation. A grass and leaves nest is placed on the ground, beneath rotting logs, or underground. Two litters are produced, in June and in late August. Two to 8 young form a litter, 5 being typical. They are weaned when 3 weeks old. Animals from the spring litter mate the same summer, those from the August litter breed the next spring. Populations of these mice range from 2 to 18 per acre.

Beetles and caterpillars are consumed in quantity during spring, after the animals emerge from winter hibernation. During summer and early autumn, seeds of grasses and herbs are important dietary items as are nuts, roots, berries, and some invertebrates. In late summer, an important part of the diet consists of fleshy fruit and underground fungi. Half the weight of the animal is eaten daily, but it does not horde food for winter.

Woodland Jumping Mouse (Napaeozapus insignis)

The Woodland Jumping Mouse is yellowish-brown on the back, with black marks, large feet, with a long,white-tipped tail. It measures up to 9.8 inches in length. Some wild individuals live up to 2 years. The Woodland Jumping Mouse is extremely scarce along the Kittatinny Ridge in Pennsylvania, preferring tumbling mountain streams with rocky edges whose overhanging banks provide protection.

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Shrews Of The Kittatinny Raptor Corridor

Shrews are small, insectivorous and/or carnivorous, predatory mammals that live along the Kittatinny-Shawangunk Range, and/or within the raptor corridor. Because of their secretive nature, many shrews are largely unknown to the general public, and the rarer species are poorly known even to naturalists and mammalogists.

Mammalogists consider shrews among the most ancient of mammals, animals with an evolutionary history extending back nearly to the end of the reign of dinosaurs late in the Eocene and early Oligocene epoch about 38 million years ago. Moreover, shrews have changed little over that long period of geologic time. Worldwide, 266 species of shrews are recognized, separated into 20 genera. The genus *Sorex*, in which many of the shrews found in the Kittatinny raptor corridor are placed, is one of the larger shrew genera containing 64 species worldwide.

In general terms, shrews consume large amounts of food daily because of their high metabolic rates. Moreover, these animals make effective use of the energy secured from their food although different types of food produce different assimilation efficiendies in the same shrews. Nevertheless, shrew diets are varied -- suggesting prey availability is the limiting factor in diet selection rather than energy availability in a prey species or the shrew's assimilation efficiency. Beetles, for example, tend to be common shrew prey items because they are generally abundant and have a good trade-off between energy and water content. Studies of captive shrews also suggest these mammals need a varied diet to secure proper nutrients necessary in their diet.

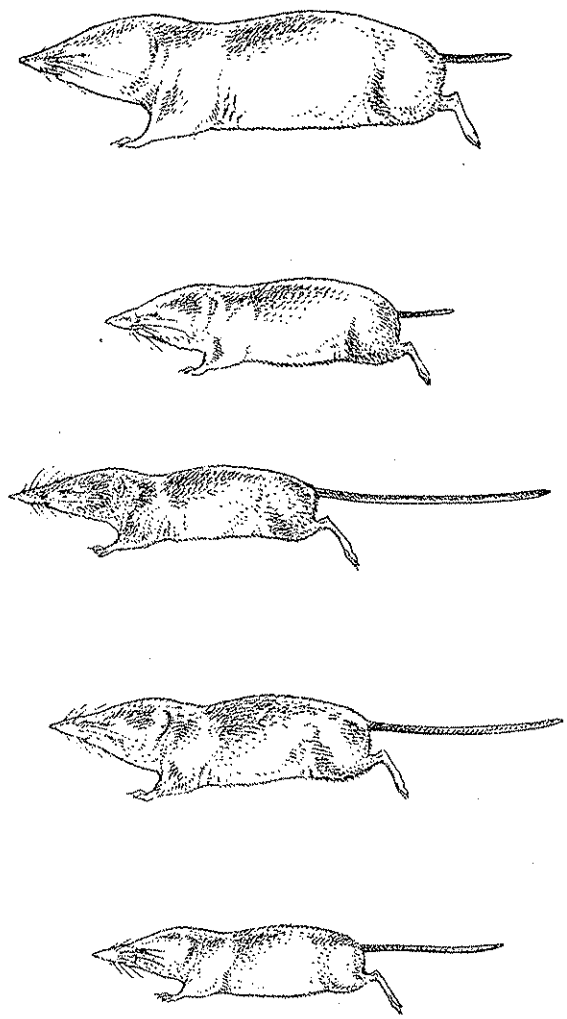
Masked Shrew (Sorex cinereus)

This grayish-brown shrew, one of the more common species, has a body 2 to 2.5 inches long, and a tail 1.25 to 2 inches long. It prefers moist forest, brush, and open country habitat. Individuals can be active during the day or at night. It places its nest of dry grasses and leaves under brush piles, or in rotting logs and stumps. The breeding season, probably between March and October, produces from 2 to 10 young. It apparently is a rare species within the Kittatinny raptor corridor.

Smoky Shrew (Sorex fumeus)

The Smoky Shrew is a small, distinctive, uniformly colored dull brown mammal with a bicolored tail. It measures 2.5 to 3 inches in length, with the tail another 1.75 to 2 inches long. It prefers deep leaf mold in hemlock and birch forests, but sometimes is found along mountain streams, as well as among boulder piles, and on the tops of mountains, where it uses its own burrows as well as those made by other animals. The nest is constructed of dry vegetation placed in logs, stumps, or among rocks. The young, perhaps 2 in number, are reared between April and June. Smoky Shrews feed on insects and small animals, and sometimes are cannibalistic. Populations of this shrew in the Kittatinny raptor corridor range from rare to common.

Shrews
(Drawings by Earl L. Poole)



Shrews of the Kittatinny raptor corridor (top to bottom): Short-tailed Shrew, Least Shrew, Long-tailed Shrew, Smoky Shrew, and Masked Shrew. Reprinted from *A Survey of The Mammals of Berks County, Pennsylvania* . 1932. Bulletin 13. Reading Public Museum and Art Gallery, Reading, Pa.

Long-tailed Shrew (Sorex dispar)

The Long-tailed Shrew is a very rare mammal in the Kittatinny raptor corridor. In summer these shrews are brown with paler underparts, but in winter their coat is slate in color. It measures up to about 5.3 inches in length, and weighs only 0.14 to 0.2 ounces. Typical habitat for the Long-tailed Shrew is a moist, cool, rocky area near mountain streams. It forages in underground tunnels among rocky outcroppings lacking much soil. Food consists of centipedes, spiders, and other small invertebrates. It probably breeds from early spring to late summer, 1 or 2 litters of 2 to 5 young being produced.

Short-tailed Shrew (Blarina brevicauda)

The Short-tailed Shrew is one of the most widely distributed and common shrews found in the Kittatinny raptor corridor. It is larger than other shrews, is colored dark slate, and has a short tail. It occurs in forests, meadows, old fields, grasslands, and other habitats with considerable leaf-litter on the ground. Populations sometimes reach as many as 10 per acre.

The Short-tailed Shrew feeds on invertebrates such as centipedes, spiders, slugs, snails, and earthworms as well as salamanders, mice, voles, and on occasion birds. In addition, it consumes fungi, berries, nuts, and fruits, and insect larvae and pupae including those of the destructive Gypsy Moth. It is noted for its food hoarding behavior, sometimes including earthworms, insects, small mammals, and seeds in the collection.

These shrews are rare among mammals in that they are venomous (European Water Shrews, *Neomys fodiens*, also are venomous), the venom being similar to that of cobras, which is released through openings near the base of the incisors. The toxic venom from the Short-tailed Shrew affects the prey's vascular and respiratory systems, resulting in convulsions, lack of coordinated movement, and eventually paralysis and death. These shrews attack their prey (such as Meadow Voles) from behind, biting the victim in the neck which injects the neurotoxin into the central nervous system. Human exposure to the venom produces pronounced irritation and swelling near the point of exposure -- a reaction lasting as long as 3 days.

Short-tailed Shrews do not tolerate other shrews, often attacking and fighting any that may be nearby. The breeding season extends from mid-March to September, with 2 or 3 litters produced per season. From 4 to 8 young are in the litter. Young Short-tailed Shrews leave the nest at the age of about 3 weeks, and can breed within 3 months.

Least Shrew (Cryptotis parva)

The Least Shrew is a small mammal with a dark brown back, ashy-gray undersides, and short tail. It measures less than 1 inch in length, and can live up to 2 years in the wild. Although it doubtless occurs in the Kittatinny raptor corridor, in habitats such as old fields, old pastures, and meadows with bluegrass and orchard grass, its exact status is not determined. It can be active either at night or during the day, but most activity takes place during evening. The breeding season extends from March to the end of November. The nest, a grassy structure, is placed under logs, stumps, rocks, or old boards. Often, 3 litters are produced per season, with 5 young forming a litter. The young shrews are weaned at the age of about 3 weeks, and females born in spring can breed later in the year. Least Shrews tend to be colonial, differing from the solitary behavior of other North American shrews. They consume large amounts of food daily, sometimes as much as its entire body weight within a 24 hours period. Among the items forming the diet are invertebrates such as spiders, centipedes, millipedes, earthworms, and even salamanders and frogs. These shrews also are known for their habit of entering beehives to eat bee larvae and pupae, thus giving the species the name "bee shrew" among beekeepers.

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White-tailed Deer In The Kittatinny-Shawangunk Raptor Corridor

White-tailed Deer (*Odocoileus virginianus*) are the most abundant, and widely distributed "big game" mammals found in the Kittatinny-Shawangunk Raptor Corridor. Deer are large animals, with a reddish-brown coat in summer and a grayish-brown coat in winter. They measure up to approximately 80 inches in length, sometimes weighing as much as 300 pounds although most are not that heavy. Older bucks (males) can support impressive antlers called racks, with many points, but two year old animals typically are only "spike" bucks.

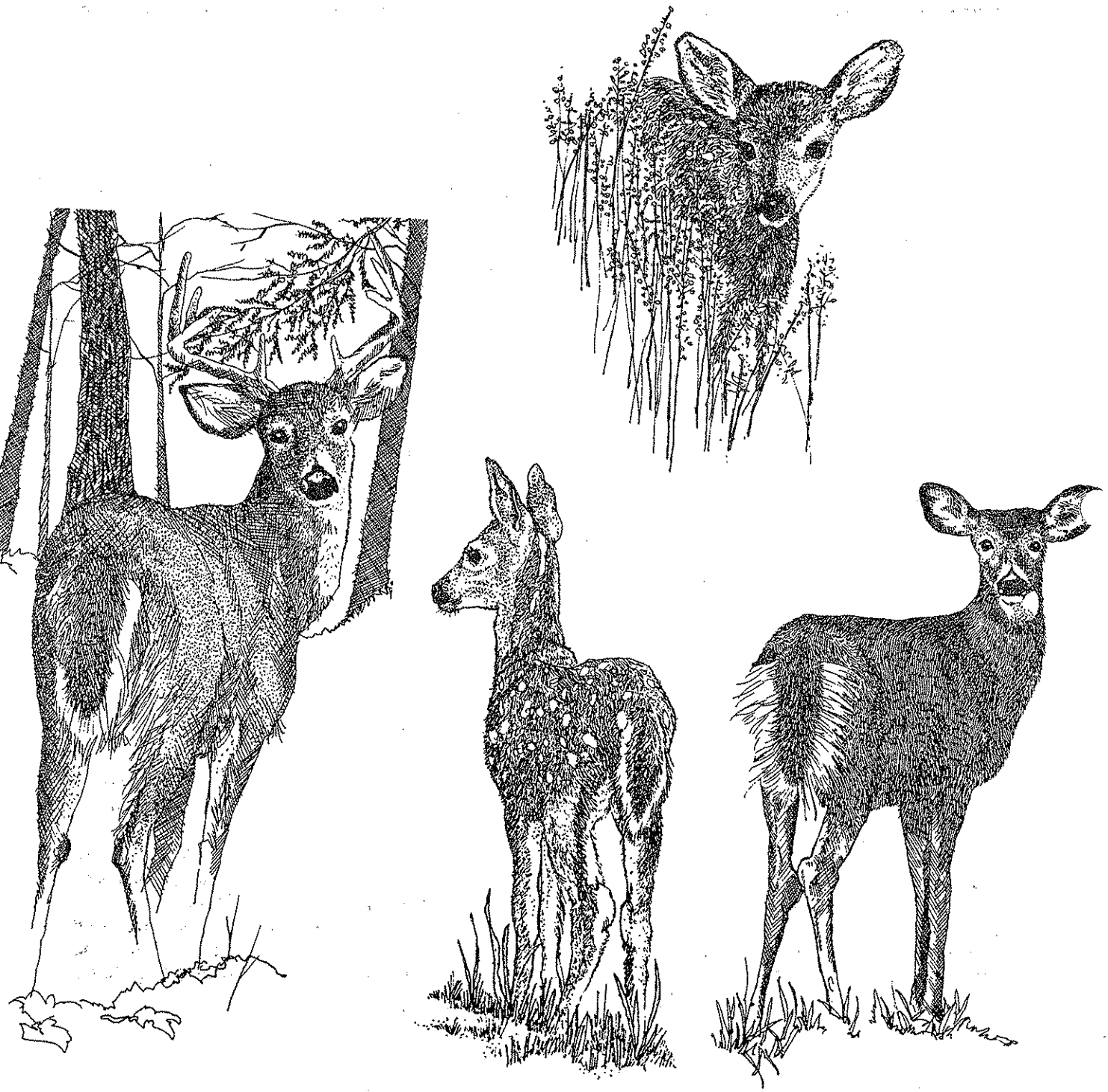
The reproductive season for White-tailed Deer begins during the autumn rutting period, which peaks in November. During this season, bucks sometimes engage in fierce jousting matches involving the use of both antlers and hooves. At times, one of the animals dies during the fights. As the reproductive season progresses, females or does undergo a period of heat for about 24 hours during which she will be impregnated by a buck. However, a second period of heat can occur a month later if the doe does not become pregnant during the first receptive period. Generally, however, most does are inseminated by late December, and undergo a 6.5 to 7 month gestation period. The young deer, or fawns, generally two in number, are born in late May and early June. Occasionally one fawn is born, and sometimes three are produced. Typically, old does and yearlings produce one fawn.

Fawns are furred and born with their eyes open. They have a beautiful spotted coat, weigh 4 to 7 pounds, and measure 17 to 19 inches in length. Although they stand soon after birth, they are weak and wobbly. However, they soon become much stronger and remain close to their place of birth for several weeks. By the age of one month, most fawns follow their mother on feeding excursions and start to eat green vegetation, but some continue to nurse for as long as six months. By early autumn, in September, the fawns begin losing their spots but nevertheless remain with their mother during the first winter. However, the young deer are capable of breeding at an age of about six to eight months.

Woodland (forest edge) adjacent to farm fields is ideal deer habitat, because the animals venture into the fields to feed at dusk and at night, but these animals also commonly live in dense forests and wilderness areas, and suburban and urban parks. Increasingly, in suburban areas, human-deer conflicts are occurring with public demonstrations and protests against hunting sometimes resulting in arrests of hunters and protestors.

The White-tailed Deer's diet is herbivorous, but actual items consumed vary from season to season. During spring and summer, for example, shoots, twigs, and leaves of maples, dogwood, black cherry, mountain ash, blueberry, and various other plants are eaten. Sometimes pine, hemlock, and yew also are consumed. In addition, farm crops including corn, alfalfa, and soybeans are favorite food items. In autumn, deer change their diets to acorns, hickory nuts, and other mast, as well as apples from orchards. The winter diet, in comparison, is meager with buds, leaves, twigs, and woody shrubs consumed as available.

White-tailed Deer



Bottom (left to right): A buck (male) White-tailed Deer; a fawn (young deer); a doe (female) deer. Top: A fawn (young deer).

At the end of the last century, as a result of extensive logging which destroyed vital habitat, deer were very rare animals in Pennsylvania. Hence, in 1896, the forerunner of the Pennsylvania Game Commission was established and deer hunting regulations were adopted. From that time to today, White-tailed Deer have recovered in Pennsylvania due to the Game Commission's continuing, and increasingly controversial, deer management policies. In general terms, however, current White-tailed Deer populations can range from 13 to 65 animals per square mile depending upon availability of food, habitat, intense hunting pressure, and other factors. Although some deer live from 3 to 8 years in the wild, many are shot and killed at a much younger age by hunters. Indeed, legal deer hunting is the primary cause of deer mortality in Pennsylvania, with unknown (but probably large) numbers of additional deer shot illegally by poachers.

In urban and suburban areas, however, as increasing numbers of people oppose hunting as the method of reducing deer populations, fertility control is being demanded as the management technique of choice. Advances in immunocontraception research with White-tailed Deer demonstrate the technique works in experimental, captive animals. As methods for delivery of the vaccine are improved for use with wild deer in urban and suburb parks and other settings, and the political will to accept the technique develops, immunocontraception probably will be the future deer management technique of choice. Regretfully, the technique probably will not be useful in most wildlands areas along the Kittatinny-Shawangunk raptor corridor.

Collisions between vehicles and White-tailed Deer crossing Pennsylvania highways, including those in the Kittatinny raptor corridor, also are increasingly serious public safety and wildlife protection problems. According to the Pennsylvania Game Commission, in recent years nearly 46,000 deer have been killed in collisions with vehicles along the state's roads. Although there is scientific evidence demonstrating the use of Swareflex (now called Strieter-Lite) roadside reflectors can significantly reduce deer-vehicle collisions when placed in suitable locations, these devices are not used in Pennsylvania.

There are no completely effective ways in which deer-vehicle collisions always can be avoided, but the following precautionary actions are available to motorists to try to reduce the possibility of hitting a deer on a highway or rural road.

- Drive defensively, and within posted speed limits. **Slow down if you see deer anywhere along the sides of the highway on which you are driving!**

- Note deer crossing warning signs. Slow down when approaching, and passing through, those areas.

- On highways along which you drive frequently, make a mental note where you see deer. Be particularly careful when driving past those areas.

- When driving along new highways, and/or when passing through areas with old fields adjacent to woodlots or woodland, **remain particularly alert just prior to and after dawn and dusk,** but also remain alert at night.

- Deer usually do not travel alone, so remain alert for more than one animal crossing a highway ahead of you. Also keep in mind that a deer crossing ahead of you may double back, or move into the path of another approaching vehicle. **Do not swerve into the path of an oncoming vehicle to avoid hitting a deer! Hitting a deer usually is less serious than causing a head-on collision with another vehicle.**

- Deer-vehicle collisions can occur during any month. However, **October through December are the peak months when these accidents occur,** because deer are then in rutting season, and hunters roaming fields and woodlands are disturbing natural behavior and movement patterns of deer.

- Ultra-sound whistles suitable for mounting on vehicle bumpers, as sold in hardware and other stores, may not be effective in preventing a deer-vehicle collision. However, they are relatively inexpensive, so until conclusive studies demonstrate their ineffectiveness some motorists may wish to continue using them.

- If you hit a deer along a highway, promptly call the state police and report the accident.

- Encourage state highway departments to install Strieter-Lite reflectors at known deer crossing areas along highways to help reduce deer-vehicle collisions. Test studies show these reflectors sometimes can reduce deer-vehicle collisions by 90%.

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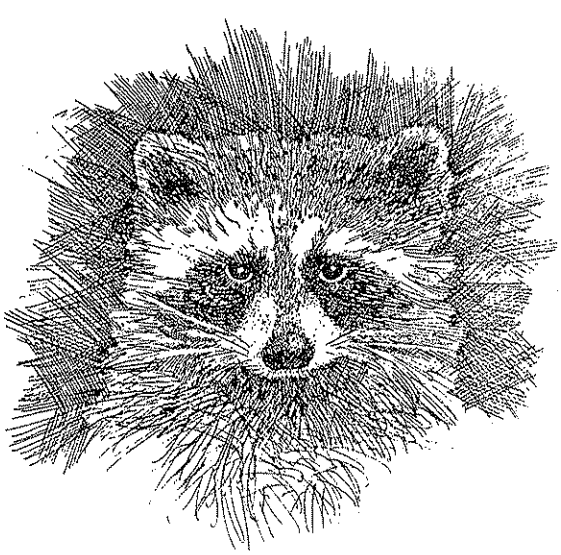
Raccoons In The Kittatinny-Shawangunk Raptor Corridor

Raccoons (*Procyon lotor*) are among the common, widely distributed mammals in the Kittatinny-Shawangunk raptor corridor. They are gray with a distinctive black face mask and 4 to 6 blackish or yellowish rings, making them distinctive and easy-to-identify. Raccoons measure up to 35.7 inches in length, and weigh as much as 33 pounds. In the wild, they live as long as 6 years.

Woodlands in close proximity to creeks, streams, rivers, lakes, and ponds are preferred habitat for Raccoons, but other habitats such as farmland and urban parks also are selected as habitat. Their populations can range from 5 to 52 per square mile.

Because of their distinctive coloration, these mainly nocturnal animals sometimes are referred to as the masked robber although an equally appropriate name would be "the washer," because of their compulsion to dunk their food in water before eating it. Naturalists believe this food dunking behavior merely represents a Raccoon's natural compulsion to handle it.

Raccoon den sites vary, but often are hollow stumps or logs, caves in rocky ledges, or other sheltered locations. A hollow trunk of a tree often is a favorite den site. Not infrequently, the den tree is located within one-quarter mile of water. These mammals breed once per year, generally during January and February, and the young are born in late March or April. From 3 to 6, often 4, young form the litter. Young Raccoons are weaned when they are about 16 weeks old, but they continue to remain with their mother during the summer and autumn as she teaches them how to climb, hunt, and other survival skills. Although the cubs are not fully adult until they are almost 2 years old, females can breed as yearlings, but males do not breed until their second winter.



The diet of Raccoons varies from season to season, but generally they are omnivorous animals -- eating whatever they can find. In wildlands areas, such as along the Kittatinny-Shawangunk raptor corridor, animal matter, insects, earthworms, birds and bird eggs, small mammals, fish, frogs, and crayfish are consumed from spring through early autumn. Carrion, such as animals killed along roads, also is eaten. However, in late autumn, corn, wild grapes, acorns, corn, and apples are major food items, and in winter corn, acorns, bark, and wood, along with other items, are consumed.

Raccoons suffer a high mortaility rate due to a variety of causes. Hunters and trappers represent the most serious threat in tha they annually kill large numbers of these animals in the name of "sport" hunting or for their fur. In addition, a large but untallied number of Raccoons are killed along highways and rural roads. Various diseases also are contracted including canine distemper and rabies.

Rabies in Raccoon populations is a particularly series problem. Indeed, in recent years, Raccoons in Pennsylvania have become major carriers of rabies and can become dangerous if an infected animal is encountered by hikers or other people engaging in outdoor activities, or if the infected animal fights with a pet dog or house cat and transmits rabies to the pet. Under those circumstances, it is possible for people to become exposed to rabies. If left untreated, death always occurs in pets and humans. Anyone with good reason to believe they have been exposed to a rabid animal must secure medical help immediately.

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The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

An Autumn Hawk Watching Field Trip To Bake Oven Knob, Pa.

Schools within the **Kittatinny-Shawangunk raptor corridor** have splendid opportunities for teachers to take students on field trips to observe migrating hawks, eagles, falcons, and other birds of prey during autumn. Ideal months to schedule field trips are September and October, before cold weather makes visits to the summit of the mountain unpleasant -- or even dangerous -- if students are not dressed properly for days with a very cold **wind chill factor.** Never underestimate weather conditions on the hawk watching lookouts!

This bulletin contains examples of activities that can be used on mid-October hawk watching field trips. It is based, in part, on field trips taken by teachers and students from Freedom High School in Bethlehem, Pa., to the lookouts at Bake Oven Knob, Pa.

Walking to the Lookout

Slowly hike northeast along the **Appalachian Trail** (marked with white **blazes** on trees or rocks) to one of the lookouts at the summit of Bake Oven Knob -- a distance of about one-third mile from the parking lot. This hike takes between 15 and 30 minutes, depending upon how much time is spent discussing natural history features along the trail. When time permits, students can be introduced to basic forest **ecosystem components** as they walk along the trail.

Arrival at the Lookout

Upon arriving at one of the lookouts (which one is determined by prevailing wind direction on the day of the field trip), select a suitable rock on which to sit safely away from the edge of the cliff. Then locate the numbered and/or named **landmarks** (indicated on an information sheet provided by the teacher) used by hawk watchers to indicate where migrating hawks are located as they fly along the ridge. Finally, at the beginning of every hour interval, measure and record on data sheets provided by the teacher basic weather data prevailing at the lookout -- **air temperature, wind velocity and direction**, percent **cloud cover**, and maximum **visibility** (measured in miles).

Searching for Hawks

Next use binoculars to search for migrating hawks. On some days the birds will be in clear view close to the lookout; on other days they may be flying much farther away. In the latter situation, **scan** the sky overhead, distant **horizons**, ridgetop and sides, and valleys. When hawks are seen, indicate to others where they are by referring to the name and numbered **landmarks** you located earlier. Are there differences among students (and teachers) in each person's ability to see distant hawks? Consider reasons why some people can see distant flying hawks more easily than other people. Are these **individual differences** important when making counts of migrating hawks for research purposes? Explore some possible answers.

Air Current Types

When, where, and how raptors fly along the ridge on any given day depends to a considerable degree upon the types of **air currents** that prevail along the ridge from day to day. Teachers and students should carefully watch the flight behavior of all hawks passing the lookout, then discuss the various types of air currents encountered by hawks while migrating along the ridge. Students then should list on their field data sheets two of the most important types of air currents used by hawks during migration, and explain when and how each is used.

1. **Deflective updrafts.**
2. **Thermals.**

Naming Hawks Observed

List the names of the various raptors you observed. The list provides a rough measure of **raptor biodiversity** or **species richness** during the autumn migration seasons. How many of the following **species** were observed on the field trip?

1. Turkey Vulture
2. Black Vulture
3. Sharp-shinned Hawk
4. Cooper's Hawk
5. Red-tailed Hawk
6. Red-shouldered Hawk
7. Broad-winged Hawk
8. Bald Eagle
9. Golden Eagle
10. Osprey
11. Northern Harrier
12. Peregrine Falcon
13. Merlin
14. American Kestrel

Major Raptor Groups

Name six species of raptors you observed from the lookout at Bake Oven Knob, and name the group (or **genus**) in which they are classified.

1. Turkey Vulture; **Vulture**
2. Sharp-shinned Hawk; **Accipiter**
3. Red-tailed Hawk; **Buteo**
4. Red-shouldered Hawk; **Buteo**
5. Peregrine Falcon; **Falco**
6. American Kestrel; **Falco**

Endangered Raptors

List the names of any **endangered** raptors you observed (or hoped to observe) on your Bake Oven Knob field trip. Did you see any of the following two species?

1. Bald Eagle
2. Peregrine Falcon

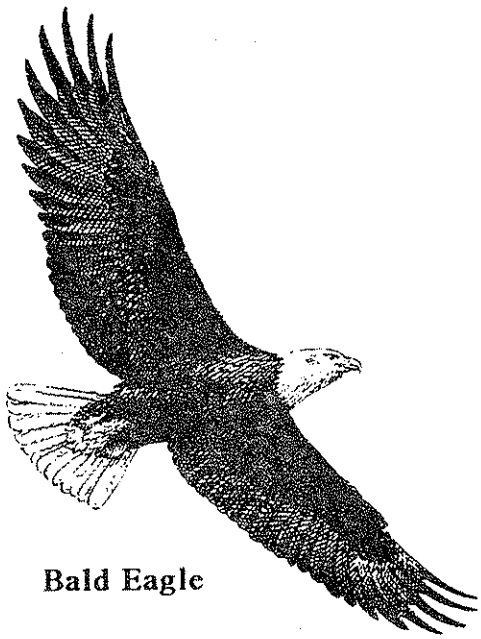
Raptor Habitats

Name the habitats in which five raptor species you observed typically nest as shown in the five following examples.

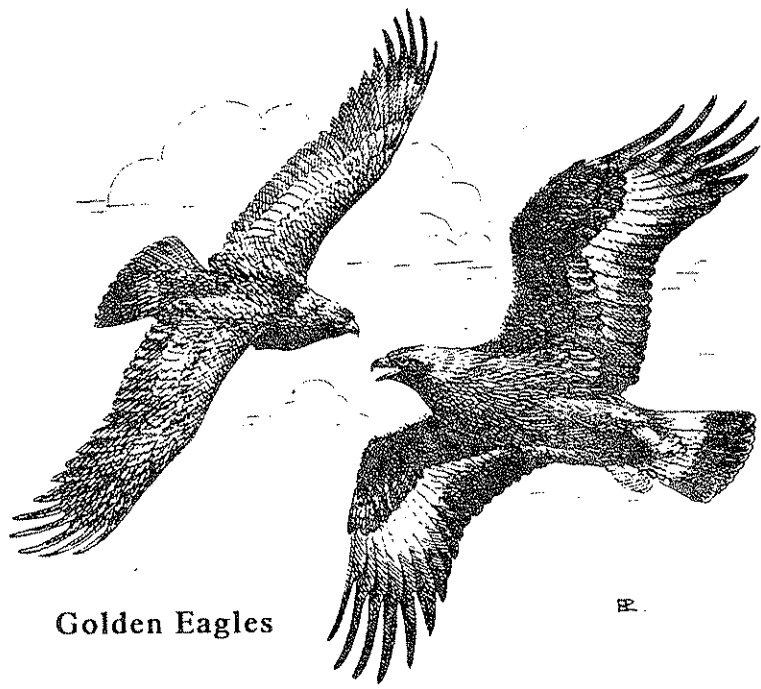
1. Turkey Vulture; caves and rocky outcroppings in forests and ridge tops and sides.
2. Sharp-shinned Hawks; coniferous forests.
3. Bald Eagle; tall trees along rivers and coastlines, forests near lakes and ponds.
4. Peregrine Falcon; Rocky ledges along rivers, and on tall buildings and bridges in cities.
5. American Kestrels; in nest boxes or cavities in trees in open fields.

Some Raptors Seen Migrating Past Bake Oven Knob During Autumn

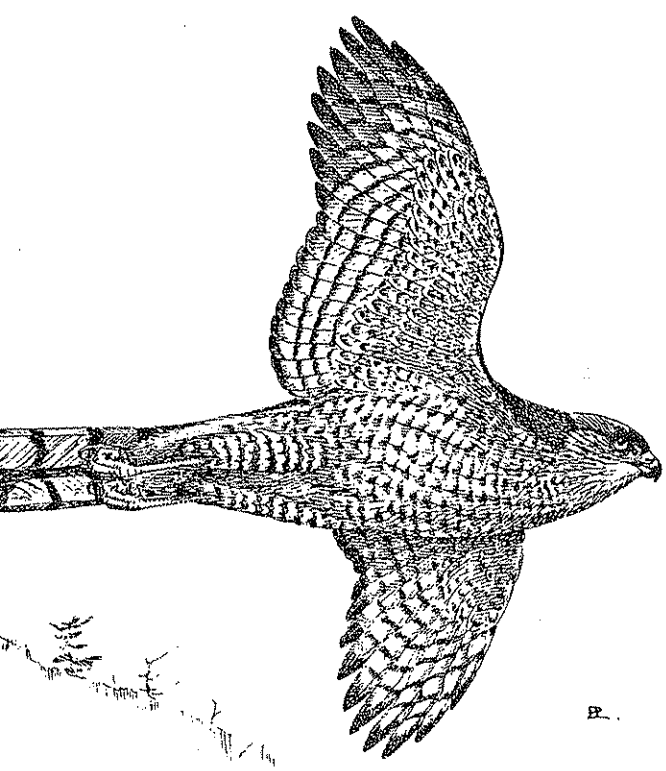
(Drawings by Earl L. Poole)



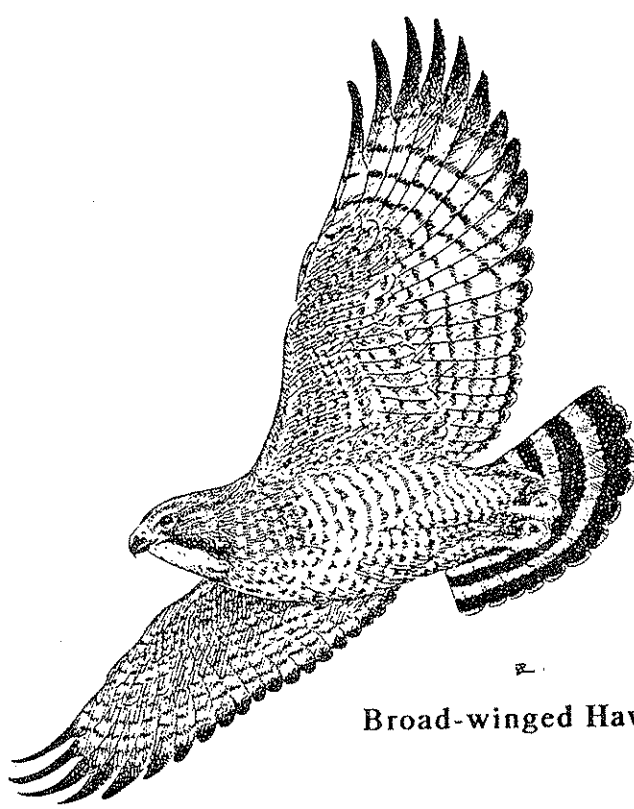
Bald Eagle



Golden Eagles



Sharp-shinned Hawk



Broad-winged Hawk

The Kittatinny Raptor Corridor as a Landscape Link

Using binoculars, examine **land use patterns** in the valleys below the lookout. Give particular attention to the amount of remaining woodland and farmland, and notice the spread or **build-out** of developments toward the mountain from which you are making observations. Discuss the Kittatinny-Shawangunk raptor corridor and its role as a **landscape link** connecting northern **breeding grounds** with southern **wintering grounds** for migratory raptors.

Will conversion of woodland and farmland into housing developments in the raptor corridor have impacts on migratory birds of prey? Discuss possible impacts that come to mind. Consider and suggest ways in which the remaining raptor corridor farmland and woodland can be preserved. Can the land be donated to a government **agency** or **non-profit** conservation organization? Why would a person, family, or business might want to donate land to a government agency or non-profit conservation organization. Can land be purchased from owners? Can conservation **easements** or **deed restrictions** be obtained at less cost than outright land purchases? How can students participate in land conservation efforts?

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Observing Forest Ecosystem Components At Bake Oven Knob, Pa.

Schools located within, or close to, the **Kittatinny-Shawangunk raptor corridor** have excellent opportunities for teachers to take students on field trips to observe basic components of **eastern deciduous forest ecosystems**. September and October are ideal months to schedule field trips, when the leaves are still on **deciduous** trees and shrubs and cold weather has not yet made visits to the raptor corridor unpleasant.

This bulletin provides enhanced details for mid-October forest **ecology** field trips taken by teachers and students from Freedom High School in Bethlehem, Pa., to Bake Oven Knob, Lehigh County, Pa. The field trip's purpose is to allow students to see forest **ecosystem components** while hiking the **Appalachian Trail** from the parking lot to the summit of the mountain.

The Appalachian Trail

Slowly hike along a section of the **Appalachian Trail**, a hiking trail running from Maine to Georgia with white **blazes** (marks) on trees or rocks, from the parking lot to the summit of Bake Oven Knob -- a distance of about one-third mile. This will take between 15 and 30 minutes, and provide excellent opportunities to locate, identify, and observe various forest **ecosystem components** at this site. In effect, you are using the trail as a **transect** through the forest.

Forest Canopy and Understory

Begin your forest examination by walking along the Appalachian Trail a few hundred feet into the forest. Look overhead at the forest's **canopy** above you. Next look at the **understory** -- smaller trees that do not reach the canopy. Then look at the lower **shrub and herb layers**. Finally, examine the **forest floor**. Name two species of plantlife found in each **layer**.

1. Red Oak (canopy)
2. Red Maple (canopy)
3. Chestnut Oak (understory)
4. American Chestnut (understory)
5. Mountain Laurel (shrub layer)
6. Sassafras (shrub layer)
7. False Solomon's Seal (herb layer)
8. Sweet Fern (herb layer)
9. Common Polypody (forest floor)
10. Trailing Arbutus (forest floor)

Light Gaps

Light gaps are open spaces in the forest canopy through which sunlight can shine onto the forest floor. Find a light gap in the canopy. Can you explain its function?

Forest Profile

Continue your forest examination by looking for the forest's **layered profile**, then make a simple drawing of the profile.

American Chestnut Observations

Somewhere along the Appalachian Trail, find and examine an American Chestnut **sapling.** Briefly explain its 19th and 20th century ecological and economic importance. Make a simple drawing of a **leaf**, and the **fruits** (if you are lucky enough to find a small tree bearing fruit).

Biological Diversity

Look around you at the variety of plant and animal **species** in the forest. Ecologists refer to the number of plant and animal species living in an **ecosystem** as the area's **biological diversity (biodiversity)** or **species richness**. How would the biodiversity, or species richness, of this forest compare with the biodiversity of an Amazonian rain forest?

Producers

The various plant and animal species living in the forest (or any other ecosystem) are separated into **producers**, **consumers**, and **decomposers**. They are important ecological components of the forest. Name any producers you observed (the teacher will help identify them). Record this information on the field data form provided by the teacher. Examples include:

1. White Pine
2. Pitch Pine
3. Northern Red Oak
4. Red Maple
5. Chestnut Oak
6. American Chestnut
7. Sassafras
8. Witch Hazel
9. Mountain Ash
10. Mountain Laurel

Consumers and Predators

Consumers also are important components of the forest ecosystem. Some consumers also are called **predators** because they capture, kill, and eat other animals. Name any consumers you observe, list what they eat, then assign a **trophic level** (feeding level) to each.

1. Eastern Chipmunk; seeds and nuts; TL 2
2. Gray Squirrel ; acorns and other seeds and nuts; TL 2
3. White-tailed Deer; leaves, twigs, acorns, and fruits; TL 2
4. Black Bear; nuts, fruits, seeds, insects, and other animal matter; TL 3 and/or 4
5. Sharp-shinned Hawk; birds, small mammals; TL 3 and/or 4
6. Osprey; fish; TL 3 and/or 4
7. Golden Eagle; rabbits, small mammals or birds; TL 3 and/or 4
8. Human Beings; seeds, nuts, fruits, meat; TL 3 and/or 4

Food Chains

In the forest in which you are walking, there are many **food chains** which interconnect to form **food webs**. Construct three (3) possible food chains in the forest you investigated, using as examples some producers and consumers you observed and identified.

Decomposers

Like producers and consumers, **decomposers** are vital ecological components of forest ecosystems. List any decomposers you see or are aware exist. What is their ecological function?

1. Crown Coral Fungi
2. Millipedes
3. Earthworms
4. Bacteria

Dead Leaves

Dead leaves are important to the forest. They gradually become **decomposed**, **recycle** and release **nutrients**, and help form soil in which new producers (wild flowers, shrubs, and trees) grow.

Ecosystem Interactions

As you walk through the forest, hundreds of **ecosystem interactions** are in progress around you. List some ecosystem interactions you observed while on the field trip.

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The Kittatinny Raptor Corridor Project

An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

Hawk Watching Lookouts In The Kittatinny Raptor Corridor

The Kittatinny raptor corridor is a major North American hawk migration route crossing parts of New York, New Jersey, and Pennsylvania. Thousands of hawks, eagles, falcons, and vultures annually migrate southward along the Kittatinny Ridge and its corridor from breeding grounds in northeastern North America to wintering grounds in the southern United States, West Indies, and Central and South America.

This bulletin presents information about selected hawk watching lookouts on the Kittatinny Ridge. They commonly are used during autumn, and sometimes in spring.

The lookouts listed here are not the only sites from which hawk flights can be observed. However, they are used most frequently. Directions for visiting them, and others, are provided in *A Guide to Hawk Watching in North America* (Penn State University Press, 1979), whereas *The Migrations of Hawks* (Indiana University Press, 1986) provides a comprehensive listing of hawk watching sites.

New York

Near Trapps (Ulster County, N. Y.). Located in the privately owned-and-operated Mohonk Preserve, Inc., near New Paltz, this rocky knob is an autumn hawk migration lookout. Entrance is through the Mohonk Preserve, Inc., for which an entrance fee is charged.

Port Jervis (Orange County, N. Y.). This roadside pullover is along the westbound lanes of Interstate-84, about 2 miles east of Port Jervis. It is a good autumn hawk migration lookout.

New Jersey

Raccoon Ridge (Warren County, N. J.). Located in northern Warren County, within the Delaware Water Gap National Recreation Area, Raccoon Ridge is atop the Kittatinny Ridge and reached via various trails from the Yards Creek Pump Storage Station near Blairstown, N. J. During autumn it is one of New Jersey's finest ridge hawk migration lookouts.

Pennsylvania

Little Gap (Northampton County, Pa.). Located in Northampton County atop the Kittatinny Ridge north of Danielsville, autumn hawk migrations may be seen from a pipeline cut crossing the mountain west of the highway, from the top of boulders west of the highway, and from vantage points within the private Little Gap Ski Area.

Bake Oven Knob (Lehigh County, Pa.). Located in northern Lehigh County north of Germansville, Bake Oven Knob is an internationally important autumn hawk migration lookout. It is reached via a short walk northeast along the Appalachian Trail to the summit of the Knob. Two parking lots are present, but no formal visitor facilities are available.

Bear Rocks (Lehigh County, Pa.). Located in northern Lehigh County north of Germansville, Bear Rocks is another excellent autumn hawk migration lookout along the Kittatinny Ridge. It is reached via a 1.5 mile walk southwest on the Appalachian Trail to the huge Bear Rocks boulder pile to the north just off the trail. The parking lots used for visits to Bake Oven Knob also are used for visits to Bear Rocks. There are no formal visitor facilities available.

Hawk Mountain (Berks County, Pa.). Located in Berks County, about five miles northwest of Kempton, Hawk Mountain is a private wildlife sanctuary, and the world's first refuge for birds of prey. Its ridgetop lookout is an internationally important autumn hawk migration observation site. A fee is charged for entrance to the sanctuary and lookouts. Visitor facilities are available.

Route 183 (Berks County, Pa.). Located on the Berks-Schuylkill County border, north of Strausstown, this large open field is National Park Service property at the top of the mountain on the west side of Route 183. During autumn, hawk watching is done from this field.

Waggoner's Gap (Cumberland County, Pa.). Located north of Carlisle, in Cumberland County on the border with Perry County, hawk watchers in autumn use a knife edge boulder pile atop the Kittatinny Ridge behind an old restaurant just off Route 74 at Waggoner's Gap.

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The Kittatinny Raptor Corridor Project
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Wildlife Information Center, Inc.
Allentown, Pa.

Scenic Water Gaps In The Kittatinny Raptor Corridor In New Jersey and Pennsylvania

The Kittatinny Ridge and raptor corridor crosses parts of New York, New Jersey, and Pennsylvania. It beings near New Paltz, New York, where the ridge is called the Shawangunk Range, continues across northwestern New Jersey, and continues southward to its termination northwest of Carlisle, Pa.

This bulletin presents brief information about the scenic water gaps along the Kittatinny Ridge in New Jersey and Pennsylvania. Several are outstanding geological features, among the most famous in North America. The gaps are presented in a northeast-to-southwest direction.

Scenic Water Gaps

Delaware Water Gap (Northampton County, Pa. and Warren County, N. J.). Located in extreme northeastern Northampton County, Pa., near Stroudsburg in the Pocono Mountains, this famous water gap was formed by the Delaware River where it cut through the Kittatinny Ridge and flows southward to the Atlantic Ocean. The gap is the centerpiece of Delaware Water Gap National Recreation Area, is considered the most scenic in the United States, and annually is visited by several million people. The geological formations at the gap are conglomerate and sandstones from the Shawangunk Formation of the Silurian age. Interstate-80 passes through the gap on the New Jersey side of the river.

Lehigh Gap (Carbon-Lehigh-Northampton Counties, Pa.). Located at the junction of Carbon-Lehigh-Northampton Counties near Palmerton in eastern Pennsylvania, Lehigh Gap was formed by the Lehigh River where it cut through the Kittatinny Ridge and flows southward on its journey toward the confluence with the Delaware River at Easton, Pa. The gap's geological formations are famous because they represent an exceptionally fine continuous rock sequence. The gap is the "type section" for the Lizard Creek Member of the Shawangunk Formation. In the 1850s, Lehigh Gap was considered one of the most beautiful and scenic in Pennsylvania. Today, it remains spectacular but is seriously degraded and polluted as a result of a century of pollution from zinc smelting operations at nearby Palmerton. However, efforts currently are underway to restore some of the vegetation on the steep slopes of the ridge in the vicinity of the gap.

Schuylkill Gap (Berks-Schuylkill Counties, Pa.). This lovely water gap is located north of Hamburg, Pa., where the Schuylkill River cuts through the Kittatinny Ridge and flows southward. Excellent exposures of quartzites of the Tuscarora Formation appear in Schuylkill Gap, and a major geologic fault produces a repetition of the formation. North of the gap, the Schuylkill River is included in Pennsylvania's Wild and Scenic River System.

Swatara Gap (Lebanon County, Pa.). Some miles before one arrives at the Susquehanna River, the Swatara Creek forms a water gap as it cuts through the Kittatinny Ridge near Indiantown Gap. The gap is famous for its Ordovician shales which contain abundant fossil trilobites (*Cryptolithus*), and very fine specimens of a rare starfish (*Hallaster*).

Susquehanna Water Gaps (Dauphin County, Pa.). Only a few miles north of Harrisburg, Pa., the Susquehanna River cuts through five mountain ridges, including the Kittatinny, as it flows southward toward Chesapeake Bay and the Atlantic Ocean, and produces five spectacular water gaps which are Registered Natural Landmarks. Hundreds of millions of years of geologic history are exposed in these gaps. Highways run through the gaps along the the east and west shores of the Susquehanna River.

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Wildlife Information Center, Inc.
Allentown, Pa.

Odd Rock Formations In The Kittatinny Raptor Corridor

The Kittatinny Ridge and its corridor crosses parts of New York, New Jersey, and Pennsylvania. It beings near New Paltz, N. Y., where the ridge is called the Shawangunk Range, continues across northwestern New Jersey, and continues southward to its termination northwest of Carlisle, Pa. This bulletin provides information about some odd rock formations located on the Kittatinny Ridge and within its corridor. They are fascinating geological features worthy of a visit.

Devil's Potato Patch (Northampton County, Pa.). Located atop the Kittatinny Ridge north of Danielsville in Northampton County, Pa., the Devil's Potato Patch is a large boulder field beside the highway crossing the mountain just south of the Appalachian Trail marker signs.

Stony Ridge (Carbon County, Pa.). Located just north of the Kittatinny Ridge, and extending for 9.1 miles from Little Gap to Ashfield, Stony Ridge is a stone wall of boulders. It is viewed at various locations as one drives east on Route 895 between Ashfield and Bowmanstown, in the north side of Palmerton, near Little Gap, and as one leaves the tunnel through the Blue Mountain heading north on the northeast extension of the Pennsylvania Turnpike.

Bake Oven Knob (Lehigh County, Pa.). Located in northern Lehigh County north of Germansville, Bake Oven Knob is an internationally important autumn hawk migration lookout. Spectacular views are enjoyed from the rocky south lookout a few hundred feet to the east of an old concrete foundation. It is reached via a short walk northeast along the Appalachian Trail to the 1,600 foot summit. Two parking lots are present, but no formal visitor facilities are available.

Bear Rocks (Lehigh County, Pa.). Located in northern Lehigh County north of Germansville, Bear Rocks is another excellent autumn hawk migration lookout along the Kittatinny Ridge. The huge Bear Rocks boulder pile to the north just off the trail is reached via a 1.5 mile walk southwest on the Appalachian Trail from the parking lots used for visits to Bake Oven Knob. Standing atop the Bear Rocks boulders, one enjoys sweeping panoramic views across several eastern Pennsylvania counties.

Dans Pulpit (Berks County, Pa.). Located in Albany Township, upridge from Hawk Mountain Sanctuary, Dans Pulpit is an impressive rock outcropping of vertical boulder columns adjacent to the Appalachian Trail. There is a superb view toward the south across the Great Valley.

River of Rocks (Berks County, Pa.). Located within Hawk Mountain Sanctuary, a private wildlife refuge and famous hawk migration observation site, the River of Rocks is a mile-long boulder field easily seen from the sanctuary's lookouts or from trails leading to it. An admission fee is charged to visit the sanctuary.

Blue Rocks (Berks County, Pa.). Located within the Blue Rocks Camp Ground near Lenhartsville, Pa., this is another long boulder field. An admission fee is charged to visit the area, which includes a commercial camp ground.

Pulpit Rock (Berks County, Pa.). Pulpit Rock is located on the Kittatinny Ridge (Blue Mountain) in Albany Township, about 0.9 mile northwest of the Blue Rocks boulder formation. Erosion of the rocks at the site produced a pulpit-like formation.

The Pinnacle (Berks County, Pa.). The Pinnacle is located in Albany Township, between Eckville on the road to Hawk Mountain and Kempton. It is a spectacular and well known Berks County geological formation composed of hard, resistant quartzite. There is a spectacular view from the summit looking over the Great Valley, and the Kittatinny Ridge extending into the distance to the northeast.

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The Kittatinny Raptor Corridor Project
An Interstate Conservation Project Monitoring A Mountain's Vital Signs

Wildlife Information Center, Inc.
Allentown, Pa.

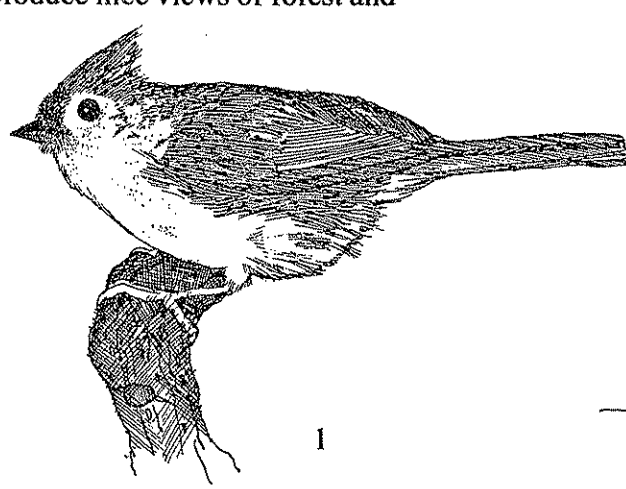
Enjoying Bird Watching In The Kittatinny Raptor Corridor

Of the many ecotourism activities in which people participate within the Kittatinny raptor corridor, none is more popular and enjoyed than bird watching. Indeed, bird watching is America's most popular and widespread nonconsumptive wildlife use activity.

Although autumn hawk watching at the Kittatinny Ridge's many fine hawk watching lookouts is the highlight of each birding year, excellent general, year-around bird watching opportunities also are available at numerous corridor locations.

Yet, within the raptor corridor, the full opportunities of this ecotourism activity still have not been utilized -- except at eastern Pennsylvania's two most famous autumn hawk watching locations, Bake Oven Knob and Hawk Mountain. Nevertheless, fine bird watching opportunities are available at many other lesser known locations, and during other seasons of the year. Not only are different seasons of the year worthwhile, but so too are different times of the day -- especially early in the morning and late in the evening. Even owl watching at night, along remote roads in the corridor, can produce unusual watching (and listening) experiences.

Walking along raptor corridor creeks, streams, and rivers during spring, for example, can produce some fine views of migrating wood warblers and other species. Or, watching for birds and other wildlife while drifting down the Delaware River in a canoe toward Delaware Water Gap on the New Jersey-Pennsylvania border can produce views of a wide assortment of wading and other waterbirds and other wild creatures. Waterfowl watching at Leaser Lake at the base of the Kittatinny Ridge in western Lehigh County, Pa., also can produce fine views of some of the more unusual species -- especially shortly after a storm has passed across the area. In mid-March, and again in late November, Tundra Swans and other waterfowl also sometimes are seen along the Susquehanna River north of Harrisburg, Pa. And, of course, hiking along sections of the Appalachian Trail as it extends along the summit of the Kittatinny Ridge in much of the raptor corridor can produce nice views of forest and woodland birds.



Tufted Titmouse (left) and Great Egret (right)

These are just some of the bird watching opportunities available to adventurous people. The essential point is that bird watchers are encouraged to venture into many sections of the raptor corridor and explore new and different locations and habitats. And, when doing so, be sure to stimulate ecotourism (and thus encourage local citizens to want to protect and preseve the Kittatinny raptor corridor) by spending money at local gas stations, restaurants, and other business establishments. Good birding!

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The Kittatinny Raptor Corridor Project
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Wildlife Information Center, Inc.
Slatington, Pa.

Scenic Wind Gaps In The Kittatinny Raptor Corridor

This bulletin discusses wind gaps along the Kittatinny Ridge (Blue Mountain) and raptor corridor in Carbon, Lehigh, Monroe , and Northampton Counties, Pa.

Wind gaps are notches in mountains where streams began cutting through the mountain, but were diverted to other places before the cutting process was completed. They are common geologic features in the Appalachian Mountains, although their name incorrectly implies they were caused by wind.

Generally, wind gaps in Pennsylvania were named for nearby families or towns. The wind gaps listed here are presented in a northeast-to-southwest direction along the Kittatinny Ridge.

Some wind gaps discussed in this bulletin are scenic geologic landscape sites forming important ecotourism attractions that can be included in ecotourism programs along their respective sections of the Kittatinny-Shawangunk Ridge and raptor corridor. For that reason it is important that land located in close proximity to wind gaps be preserved as open space and conservation areas via appropriate zoning designations or other land preservation techniques.

Unfortunately, the landscape beauty of some sites such as Lehigh Furnace Gap are degraded by communications towers at their summit. Land use planning decisions allowing construction of communications towers in wind gaps, and atop other sections of the Kittatinny Ridge were made before the development of public awareness and interest in ecotourism. As a result, scenic landscape degradation has occurred in some sections of the mountain. Elsewhere, for example, particularly at Little Gap, several private houses, a ski lodge and shop, numerous ski slopes, and ski lifts exist at the gap. The visual impact of these structures, seen from the north side of the mountain, seriously degrades the mountain's natural features and its ecotourism values.

Tott's Gap (Northampton County, Pa.). Tott's Gap is located in northern Northampton County, Pa., southwest of Delaware Water Gap, near the extreme southern edge of the Pocono Mountains. It is a relatively shallow wind gap, easily overlooked by casual observers.

Fox Gap (Northampton County, Pa.). Fox Gap is located in northern Northampton County, Pa., southwest of Tott's Gap, near the extreme southern edge of the Pocono Mountains. It also is a relatively shallow wind gap easily overlooked by casual observers.

Wind Gap (Northampton County, Pa.). Located in northern Northampton County, Pa., near the extreme southern edge of the Pocono Mountains, this gap is the most widely known wind gap in the United States. Generally known locally, and on road maps, as Wind Gap, geologists sometimes refer to it as "Pen Argyl" Wind Gap. The formation of "Pen Argyl" Wind Gap was via a process similar to that described for the formation of Little Gap (see below), but both Delaware and Lehigh River tributaries -- McMichael, Lake Bushkill, Ross Common, and Aquashicola Creeks -- were involved in the geologic process that formed the gap.

Smith Gap (Northampton County, Pa.). Smith Gap is in northern Northampton County, Pa., between Wind Gap and Little Gap. It, too, is a relatively shallow wind gap easily overlooked by casual observers.

Little Gap (Northampton County, Pa.). Located north of Danielsville in Northampton County, Pa., Little Gap has a notch more than 300 feet deep. The gap was formed when Wild and Hunter Creeks, currently located north of the Kittatinny Ridge (Blue Mountain), and Indian Creek (now a tributary of Hokendauqua Creek) south of the mountain, had been joined and flowed southeast through the gap as a single creek. However, when the growing Aquashicola Creek's headwaters extended backward at a lower level than the then-combined Wild-Hunter-Indian Creek, the Aquashicola Creek diverted the upper waters of the Wild-Hunter Creeks away from Little Gap and into the Lehigh River.

Lehigh Furnace Gap (Lehigh County, Pa.). Located north of Slatedale in northern Lehigh County, Lehigh Furnace Gap was formed by Lizard Creek which flows along the north base of the mountain and which attempted to cut its way through the Kittatinny Ridge (Blue Mountain). The process failed, however, and later Lizard Creek was diverted along the north base of the mountain to its junction with the Lehigh River at Bowmanstown, Pa.

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The Kittatinny Raptor Corridor Project

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Wildlife Information Center, Inc.
Slatington, Pa.

An Automobile Ecotourism Route in The Kittatinny-Shawangunk Raptor Corridor

The Kittatinny-Shawangunk Ridge and its corridor crosses parts of New York, New Jersey, and Pennsylvania. It beings at Rosendale, N. Y., where the ridge is called the Shawangunk Range, continues across northwestern New Jersey, and in Pennsylvania extends southwestward as the Kittatinny Ridge (Blue Mountain) to its termination near the Maryland border.

Although less formally structured and managed than the famous Blue Ridge Parkway in the southern Appalachian Mountains, the completed Kittatinny-Shawangunk Raptor Corridor automobile ecotourism route will serve a purpose similar to the Blue Ridge Parkway. It will provide structured, automobile ecotourism opportunities to the entire raptor corridor. Used wisely and imaginatively, numerous rural raptor corridor communities should receive important, sustainable economic benefits. In turn, local economic benefits should encourage greatly increased public support for preservation of the raptor corridor's most important ecological, scenic, and wildlife areas which serve as visitation destinations for automobile ecotourists.

This bulletin identifies and describes the first in a series of inter-connecting scenic rural Pennsylvania ecotourism roads. As additional roads are identified, and linked to those already selected, the eventual result will be an automobile ecotourism route extending the entire length of the Kittatinny-Shawangunk Raptor Corridor in New Jersey, New York, and Pennsylvania.

Church Road (Lehigh County, Pa.). Located in Heidelberg Township, Lehigh County, Pa., Church Road is a two-lane, secondary ecotourism road winding northward to the base of Bake Oven Knob atop the Kittatinny Ridge. The road crosses several high hilltops, one called the Bull's Head, providing superb panoramic views of Bake Oven Knob and the Kittatinny Ridge. During October, autumn leaves in woodlots adjacent to the road and the Kittatinny Ridge are very colorful. Birds of prey sometimes perch on utility wires, poles, or trees, or are seen flying overhead. Waterfowl and other waterbirds also are seen at a restored wetland at the intersection of Church and Reservoir Roads. By driving south from Mountain Road, onto Church Road, and continuing a few miles to Heidelberg Union Church, one can visit graves (with markers written in German) of nearly a dozen American Revolutionary War veterans.

Germans-Stone Mountain Roads Loop (Carbon County, Pa.). Located in East Penn Township, Carbon County, Pa., the Germans-Stone Mountain Roads Loop passes across the Lizard Creek at its east and west entrance points, and generally parallels the north side of the Kittatinny Ridge (Blue Mountain) as it passes along a relatively rural Pennsylvania German farmland setting. There is a particularly scenic view of the north side of the Kittatinny Ridge looking south from the top of Stone Mountain Road. Autumn leaves are very colorful during October. Watch for birds of prey, and Eastern Bluebirds, at various locations along the loop.

Little Gap-to-Wind Gap Road (Carbon-Monroe-Northampton Counties, Pa.). This rural road runs for 13 miles along the north base of the Kittatinny Ridge between Little Gap (Carbon County) and Wind Gap (Monroe-Northampton County). Increasing land development is present at both ends of the road, but some beautiful sections remain intact providing excellent examples of a rural Pennsylvania landscape from decades past. The Aquashicola Creek flows adjacent to the road along the southwestern (Little Gap) end of the road, feeding a freshwater marsh at that end, although an expanding ski resort adjacent to the marsh degrades the rural landscape character of the area. Nevertheless, during October, some sections of the road provide good opportunities for observing and photographing autumn leaves.

Mosserville Road (Lehigh County, Pa.). Located in Lynn Township, Lehigh County, Pa., this two-lane road runs for 1.8 miles between Routes 309 and 143 north of New Tripoli. To enter the road, drive north on Route 309 for 2 miles from the junction of Routes 143 and 309 near New Tripoli, then turn left (west) onto Mosserville Road. After approximately 0.8 miles, enjoy a very scenic spot with an old stone farmhouse on one side of the road and a barn and another farmhouse across the street. Look for an enormous, old growth Sycamore and smaller Horse Chestnut trees directly beside the road at this spot. The Sycamore, which forms two branches from a massive trunk, is said to be the oldest tree in Lehigh County. The road is very scenic and attractive during October, when autumn leaves are in full color.

Mountain Road (Lehigh County, Pa.). Located in Lynn, Heidelberg, and Washington Townships, Lehigh County, Pa., Mountain Road is a busy two-lane road paralleling the south side of the Kittatinny Ridge (Blue Mountain). At the southwestern end, it intersects U. S. Route 309 about 2 miles north of New Tripoli, and at the northeastern end it intersects Lehigh Gap where the Lehigh River cuts through the mountain.

Mountain Road can be entered from either end, or from numerous rural roads (including Church Road) heading north toward the Kittatinny Ridge (Blue Mountain). Starting from the Route 309 end, enjoy views of many scenic attractions including an old growth White Oak tree directly beside the road, the dramatic profile of Bake Oven Knob atop the ridge in Heidelberg Township, Lehigh Furnace Gap, and eventually Lehigh Gap at the northeastern end. Many of the smaller rural roads extending north or south from Mountain Road also are scenic, and can be explored as worthwhile side trips. Autumn leaves usually are very colorful during mid-October. Watch for birds of prey perched on utility wires or trees, or flying overhead.

Wanamakers-to-Eckville Road (Lehigh and Berks Counties, Pa.). The charming Wanamakers-to-Eckville Road extends across a small section of Lynn Township, Lehigh County, and a significant portion of Albany Township, Berks County. The road passes through a scenic, relatively undeveloped, section of Pennsylvania German countryside, with Hawk Mountain Sanctuary located atop "the corner" just above Eckville. In addition to historic stone farmhouses and other buildings, farms, several former single-room schools, roadside ponds, and meadows and pastures are settled against the south side of the Kittatinny Ridge which the road parallels. Autumn leaves are very colorful during mid-October. Watch for birds of prey on utility wires or trees, or flying overhead.

One can enter this road from Pa. Route 143 at Wanamakers, or from the Eckville end by turning east onto the road at a hillside church and old schoolhouse. When arriving at Wanamakers, be sure to stop at the general store and make purchases.

From spring through autumn, consider riding the W K & S Railroad which uses steam locomotives to pull passenger cars along a scenic, rural section of existing railroad track between Wanamakers and Kempton. Tickets can be purchased at the Kempton train station, along with a variety of souvenirs. There also is a privately owned and operated antique shop, generally open on weekends, in the old Wanamakers train station.

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Wildlife Information Center, Inc.
Slatington, Pa.

Selected Raptor References For The Kittatinny-Shawangunk Raptor Corridor

Raptors (birds of prey) are among the most popular and spectacular forms of wildlife. During autumn (September through November), annual southward hawk migrations are the major wildlife attraction along the Kittatinny-Shawangunk Ridge and its corridor.

After centuries of persecution, raptors now are protected by federal and state laws. They also are the subjects of many books, and articles in journals, magazines, newspapers, and other sources. The books listed here contain helpful information about many aspects of raptor biology, conservation, ecology, natural history, management, and protection. Most libraries own some of these. If not, ask the librarian to get the book by inter-library loan.

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