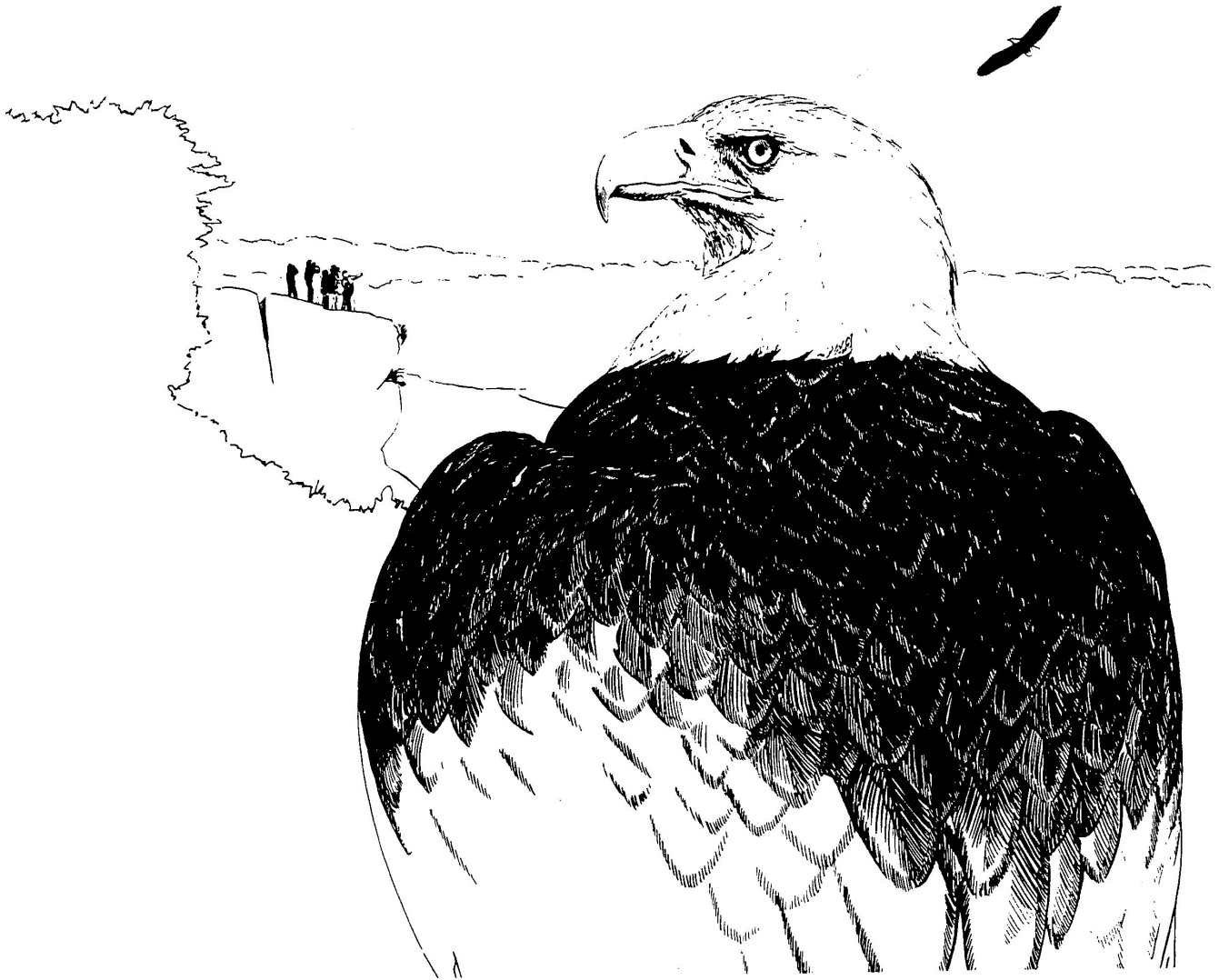


The Bald Eagle

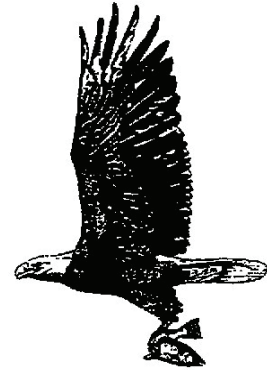
An Educational Activity Guide



**US Army Corps
of Engineers®**
Rock Island District

Mississippi River Project

Dear Educator:



Attending Bald Eagle watching events with your students is a great way of giving them a closer look at this majestic bird. This guide is designed to supplement the experience they have at the event and help them continue to learn more when they return to the classroom. The enclosed materials can be used as a guide to explore more in depth those qualities that make our national symbol, the American Bald Eagle such an amazing bird of prey.

Each year the U.S Army Corps of Engineers, Mississippi River Project sponsors a number of Bald Eagle watching events along the Mississippi River. You can find a current schedule of Bald Eagle events on our website at: **www.missriver.org**.

We hope that you and your students find this guide helpful and informative.

Sincerely,

Mississippi River Project
Natural Resource Management Section



**US Army Corps
of Engineers**
Rock Island District

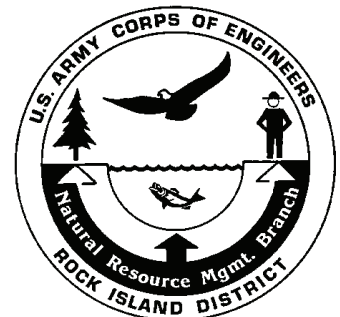


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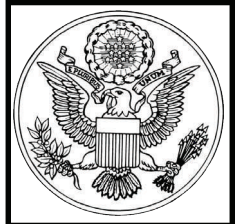
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Introduction



The American Bald Eagle is lucky to be our national symbol and to receive so much attention. The Bald Eagle was once a species of great concern and we feared it would become **extinct**, disappearing forever. Populations have since recovered and the species was removed from the U.S. federal government's list of **endangered species** and transferred to the list of threatened species on July 12, 1995. It was removed from this list completely on June 28, 2007 and is no longer considered an endangered or threatened species in the lower 48 States.

Once common throughout the United States, bald eagle populations crashed in the 1960's due to pesticide (**DDT**) use and **habitat** loss. Numerous rumors of eagles carrying away children led to the senseless killing of eagles. Tall tales of eagles killing livestock also led to the shooting and poisoning of our national symbol.

Attitudes have since changed. People are recognizing the need for protecting our national symbol. Bald Eagle Days is an excellent time to learn some **characteristics** of eagles, explore how this species made its comeback and investigate what problems may still exist.

Teachers: Use the materials in this activity guide in your classrooms or as take home projects. Feel free to duplicate these materials.

Bald Eagle Watch



This guide is not just for science teachers. Environmental education can be used in many subjects. Eagles can be the topic in English, Art, History or Math. For example art teachers can research the use of **raptors** in art history. English teachers can research the use of eagles in literature. The possibilities are endless.

Bald Eagle Days is perhaps one of the best opportunities to educate people of all ages the importance of our national symbol.



The Natural History of Bald Eagles

Objectives:

- 1) Be able to describe bald eagle physical **characteristics** (size, color, weight, and age).
- 2) Be able to describe the life cycle and **habitat** requirements of bald eagles.
- 3) Be able to describe bald eagle reproduction and nest construction. Determine environmental factors necessary for successful reproduction.
- 4) Be able to identify unique **characteristics** which help eagles to survive (**talons**, wings, beak, and eyes).
- 5) Be able to describe the mechanisms of flight.
- 6) Be able to locate areas on a map where eagles go for the winter and why.
- 7) Be able to tell the difference between adult and juvenile Bald Eagles and a Golden Eagle.



Bald Eagle Biology

Bald Eagle (*Haliaeetus leucocephalus*) means “White-headed sea Eagle”

Length:

Males 30-35 inches
Females 34-43 inches

Weight:

Males 8-9 pounds
Females 10-14 pounds

Wingspan:

Males 6-7 1/2 feet
Females up to 8 feet

Flight Speed:

Up to 100 mph while diving
20-60 mph when in normal flight

Life Span:

20-30 years in the wild
Up to 50 in captivity

Eye Sight:

Sight so powerful they could read a newspaper 100 yards away and see up to 3 miles. Their eyes work independently from each other. They can focus on a fish and look for obstacles at the same time.

Habitat:

Eagles need an environment of quiet isolation with clean water within 300 yards. They choose tall mature trees between 50 and 150 feet for perching and nesting.

Food:

Mainly fish. Bald Eagles will eat suckers, northern pike, muskellunge, bullheads, and shad. In addition to fish, hungry eagles will also eat seagulls, waterfowl, **carion**, small mammals, reptiles, and amphibians. Indigestible feathers, fur, and bones are regurgitated as pellets called casts. Eagles can store about 2 pounds of food in their crop, allowing them to go days without food.

Coloration:

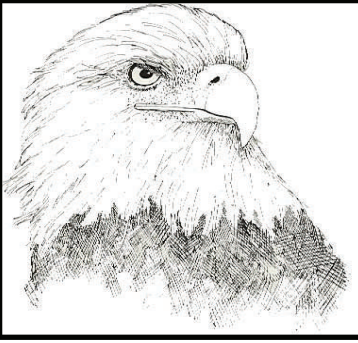
Adults: Conspicuous white head and tail. Chocolate brown body. Yellow beak, feet and eyes. Adult plumage is seen after 4-6 years. Juvenile: Same rich chocolate coloration with splotches of white on the underside of body and wings. Yellow feet and brown beak and eyes.

Eyrie:

Nests are built in the tree tops of old tall living white or red pines and deciduous trees. Nests are built of branches, moss, grass, and feathers. Parents use the nest year after year, adding additional material each year. One nest in Florida was 10 feet across, 25 feet deep, and weighed 2 tons.

Reproduction:

Eagles mate for life. They lay one to three eggs usually in March or April to avoid summer heat. The oldest one usually survives. Eggs are 2 by 3 inches and creamy yellow. Both parents incubate the eggs for about 35 days. The **fledglings** are able to fly approximately 75 days after hatching.



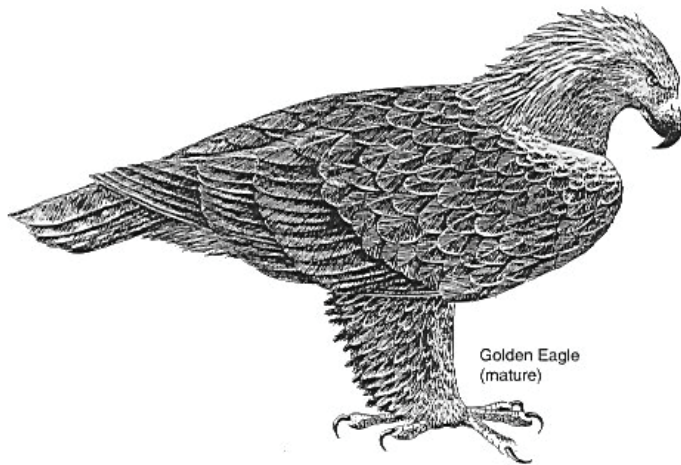
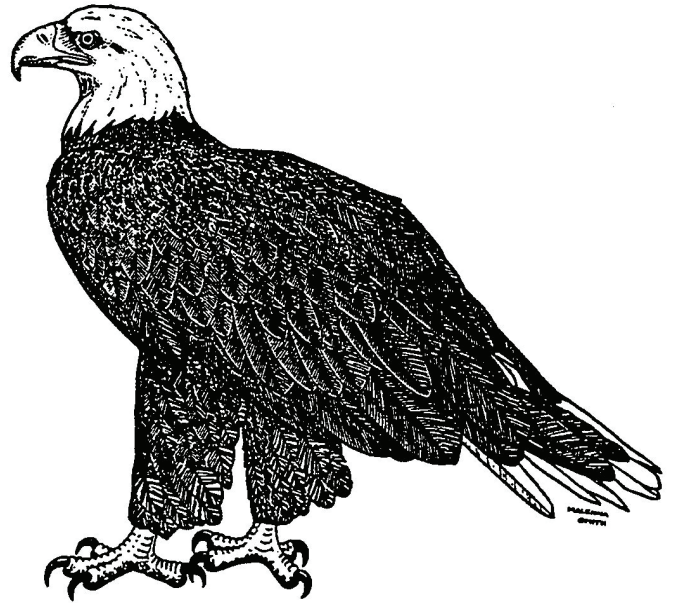
More Eagle Biology

Females: A Bigger Bird

The female Bald Eagle is appreciably larger than the male. Her **wingspan** may measure 7 and one half feet to his 6, and she may stand more than 3 feet tall to his 2 and one half. This **reverse sexual dimorphism** is a **characteristic** common to many birds of prey. Presumably, the size differential enables the larger female to present a formidable presence as guardian of the nest, eggs, and young and allows the smaller male to take the role of defender of the **territory** because he is able to maneuver more quickly in aerial combats.

Bald Eagle Diversity

In the U.S. there are two races of the Bald Eagle. The northern and the southern race. The southern race nests primarily in the estuarine areas of the Atlantic, Gulf coasts, and the lower Mississippi Valley. This race is slightly smaller but is still the same species.



Golden Eagle
(mature)

Baldie Is Not Alone

What about other Eagles in the United States? There is only one other eagle in the U.S. The Golden Eagle is found in remote mountains, tundra, grasslands and deserts of western United States. Golden Eagles have a dark brown color and the tail is barred or spotted. Immature Golden Eagles have white wing patches at the base of the tail. Its legs are feathered to the toes and it feeds mostly on rodents. They feed mainly on ground squirrels, hares, and birds such as cranes, owls and ptarmigans. The juvenile Bald Eagle can be easily confused with the Golden Eagle. They differ in that Bald eagles live near water in Canada and throughout much of the United States, eat mainly fish, and do not have feathers down to their feet.



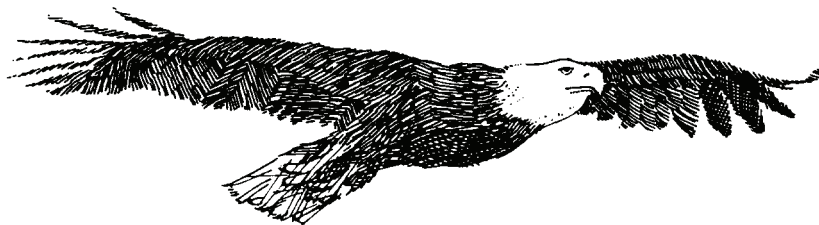
Attributes

What Makes an Eagle Unique?

- Eagles have keen vision
- Eagles have sharp **talons**
- Eagles have curved beaks
- Eagles have feathers

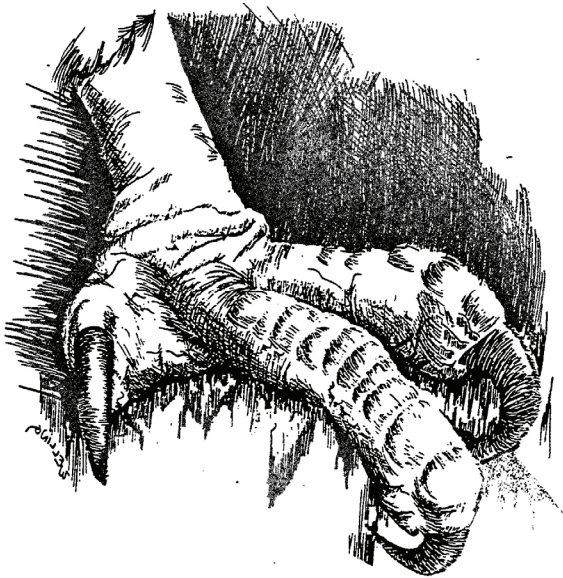
What is an attribute?

All creatures have special physical features or behaviors called **attributes** which help them survive in their **habitat** or **ecological niche**. Eagles are no exception. Birds of prey are also **predators** of the sky. They have special **characteristic** eyes, feet, beak, feathers and wings to help them hunt for prey in their specific **habitat**. Eagles have very powerful wings and **talons** to carry off their meal. Their sharp powerful beak is designed to tear fish and flesh into edible pieces. These **characteristics** are explained in more detail in the following pages. Prey species on the other hand, are camouflaged to avoid being seen by **predators** like the eagle. The fur, scales and feathers of prey species are designed to blend in with their surrounding **habitat**. That is why most species are darkly colored on the top or as seen from above. Only when a prey species moves does it become visible to a **predator**. Have you ever seen a rabbit freeze in its tracks if you walk too close? This is a behavior that helps them to avoid detection by **predators**.



Predator of the sky

Raptor in Latin means to seize and carry. All Eagles, along with vultures, hawks, falcons, and owls are considered **raptors** or birds of prey. **Raptors** have the ability to kill live prey, and as **predators** are situated at the top of the **food chain**. The word **raptor** also reflects how the birds hunt for prey. A hunting eagle will search for food by focusing on the movement of its prey. Once an eagle notices the movement of its prey, it will swoop down and try to grab the prey with its **talons**. When an eagle does catch a fish, small mammal, or a small bird, the prey is killed quickly by the impact of the strike and strength of the sharp piercing **talons**. Once the prey has been caught, it is carried away to be eaten. **Raptors** play a special role in nature. They prey on weak, sick, or old animals removing them from the community. This allows healthy strong individuals to use limited resources such as nesting sites, food, and wintering **habitat** to survive and raise young. Without **predators** the earth would be over run with pests such as rodents and insects. **Predators** are vital components to healthy ecosystems.



Talons

Talons are a special **characteristic** of the feet of eagles. **Talons** are the sharp claws used to grab and help kill the prey. The bottom of a bald eagle's rough toes are covered with small bump like projections called spicuales that also help to hold on to slippery fish.

Eagle Eyes

Did You Know?

- Bald eagles have vision 6-8 times better than humans. If an eagle was sitting on one goal post of a football field, it could read a newspaper on the other goal post.
- Eagles have binocular vision. They are able to use both eyes simultaneously to view an object.
- Eagles have two eyelids. All **raptors** have a second eyelid called the nictitating membrane. The nictitating membrane protects the eye from damage when an eagle catches its prey or feeds its eaglets. It also moistens and cleans debris from the eye.
- Eagles close their eyes by moving the lower lid up. Look in the mirror. How do humans close their eyes?
- A bald eagle can see a fish underwater from over 1.5 miles away.



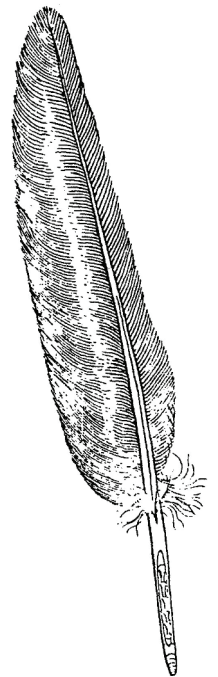
Beaks



- The bald eagle's powerful curved beak is designed to tear and rip the flesh of fish prior to its consumption.
- Eagles do not catch their prey with their beaks.
- The beaks of **raptors** reflect the size and type of prey hunted.
- Look at a kestrel's beak or another bird of prey. Can you guess what they eat?

Feathers

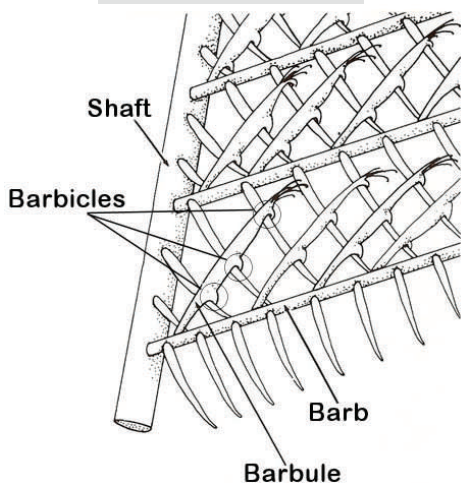
Feathers are unique to birds. No other group of animals have feathers. Birds have several types of feathers: down, contour, and flight. The soft down type feathers are located close to the body under the contour feathers. They function to keep the bird warm and help regulate body temperature by providing excellent insulation. Down traps air in tiny spaces, thus avoiding loss of heat. Contour feathers are located on the birds body, wings, and tail. These overlapping feathers contain more structure making the bird streamlined and aerodynamic for flight. Flight feathers are specialized contour feathers which are attached to the wing. The overlapping of these feathers produce a large broad flat surface necessary for flight.



Fun Facts About Feathers

- It is against the law to possess even one eagle feather without a permit from the **U.S. Fish and Wildlife Service**.
- Birds preen to clean their feathers and rehook any barbs and barbules which may have become detached from its neighbors.
- Birds have special oil glands at the base of their tail which is used to waterproof the feathers.
- The word bald comes from the Old English word "balde" which means "white" and refers to the white feathers covering the head of mature bald eagles.
- A bald eagle has roughly 7,000 feathers which weigh almost two pounds. A bald eagle weighs 8-14 pounds. That's a lot of feathers!

Close up of a feather

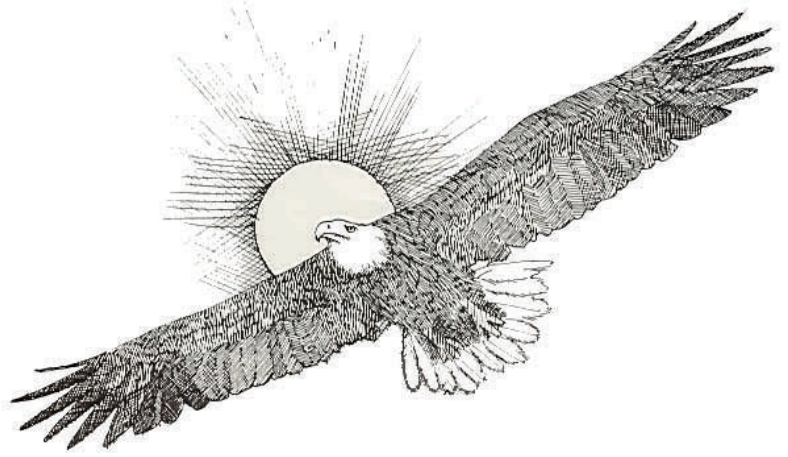


What is a feather?

The central part of the feather is called the shaft or quill and this supports two opposite rows of barbs that, when linked together form the vane of the feather. Two sets of barbules branch off from each barb and interlock by means of even smaller barbicels to give the feather great strength and smoothness.

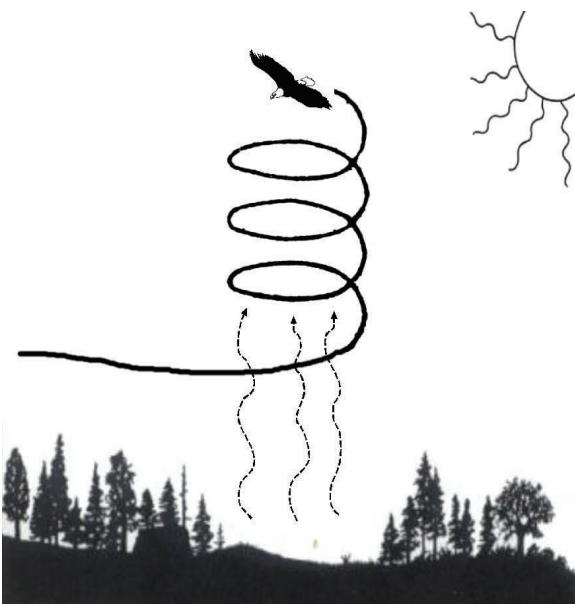
Flight

Birds fly when air flows over the top of the wing. The front of the wing is thick and narrowed at the back allowing the wings to cut through the air. This forces air over the top of the wing which lifts the body of the bird. Only when the air pressure under the wing is greater than the mass or weight of the bird will the bird fly. The faster the air moves over the top to the wing, the greater the lift of the wing.



Fun Facts About Flight

- Birds have hollow bones which make them very light.
- The bald eagle needs broad wings to lift its heavy prey into the air. An eagle cannot lift more than its body weight.
- Migrating bald eagles have been tracked flying at more than 60 miles per hour.
- Tail feathers act as a rudder, allowing the bird to steer during flight.
- Bald eagles spend the majority of their flight time soaring rather than flapping their wings.



Thermals

Warm air is lighter than cold air. Cold air surrounding the thermal is sucked in as the heated air rises. The pocket of warm air rises like a balloon, floating on the cool air below. Once in the thermals, the eagles soar, using little energy to maintain flight.

Air Currents

Another way eagles conserve energy is by using natural air currents formed in front of bluffs. Air is forced upward as the wind hits the front of the structure. Eagles ride the wind to gain altitude.





Activity Page

Preening

Obtain some chicken feathers and place them on an overhead projector. Have participants identify contour and down feathers and the parts of a feather (shaft, barbs, vane, and barbules.) Have participants rub the feather the wrong way to separate barbs. Now have them pull the feather through their fingers to reconnect the barbs to simulate a bird preening. Note: it is illegal to possess feathers from any migratory bird.

Wing Shape

At low speeds the bald eagle's broad wings can hold the bird up in the air longer than the narrow wings of the peregrine falcon. Investigate the mechanisms of flight, discovering how wide wings help eagles soar. Take two pieces of paper of equal weight and fold one of them in half and then again. Drop the two pieces from the same height at the same time. Discuss why the wider paper drops slower than the narrower (folded) one. Compare the wide wings of the bald eagle with the narrow wings of the falcon. Pretend the wide paper reflects the wings of a hawk and the narrow paper that of a falcon. Discuss why narrow wings are an advantage for the falcon and why wide wings are more suitable for the type of prey eagles (compare hunting methods, prey species, and their **habitats**).

The Speed of Flight

Eagles change position of their wings to increase or decrease their speed of flight. To show students how an eagle can increase or decrease its flight speed have students take a piece of cardboard and mark it with an 'X.'

- A Have the students hold the cardboard so the 'X' is toward the ceiling and move it back and forth. With little air resistance, this action simulates an eagle flying fast. Eagles fly fast by turning the front edge of the wing into the wind.
- B Now take the cardboard and face the 'X' toward the wall. Fan it back and forth. Feel the air resistance. This action simulates how an eagle slows down. When an eagle wants to land, it spreads its wings, causing air resistance and blocking the wind.

Note: These exercises were adapted with permission from *Zoobooks Eagles* a publication available from Wildlife Education, Ltd., 9820 Willow Creek Rd., Suite 300, San Diego, CA 92131-1112.



Eagles in Society

Objectives:

- 1) Describe how eagles are used as symbols in our society.
- 2) Learn how eagles are viewed and valued by Native Americans.
- 3) Describe how eagles were used as symbols historically.
- 4) List which activities of humans have caused a decline in eagle populations.
- 5) List activities of humans which help eagle populations.
- 6) Discuss what you can do to help eagles.



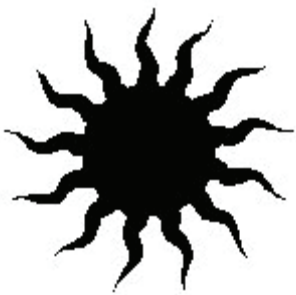
Native American View

Graceful, majestic, and powerful; the bald eagle symbolizes nobility and spirituality for Native Americans. The legend of the eagle, like all legends, is an integral part of tribal life. When elders tell a legend, they pass on life wisdom and experience to the young, preserve tribal history, and entertain. To the Native American, often the vivid stories tell of how things came to be and pay respect to the land, water, air, and wildlife.

The eagle's power is well established in the religious and social traditions of some North American Indians. Rooted in ancestral stories, the Thunderbird was a huge bird of prey believed not only to cause thunder and lightning, but also capable of carrying off a human being. Often referred to as the Thunderbird, the eagle's image can be found in the designs of ceremonial costumes, blankets, and jewelry. Only people who have done good deeds may wear eagle feathers in their regalia. Feathers may be given as gifts during special ceremonies.



Before the white man's arrival in North America, the eagle was chosen as the family symbol or totemic figure by groups of natives in southeast Alaska. Since eagles were important figures in the lives of northwest coast Indians, there were many interesting stories depicting relationships between the birds and the people. The eagle's image was used in carvings, dances, songs, facial and body painting, and tattooing. Some tribes carved an eagle, their symbol of ancestral immortality, on their totem poles. An eagle dance simulated the bird's motions.



In Pueblo mythology the eagle is believed to have a close relationship with the Sun because it often soars out of sight. The feathers of the eagle were believed to carry prayers to the heavens. The Pueblo Indians of the southwest wore the long feathers of the eagle's wing on their arms during their rain dances.

For the Iroquois tribes of the eastern woodlands, eagle feathers symbolized bravery in battle and the honor that went with it, and eagle feathers and down decorated costumes, headdresses, prayer sticks, coup bravery sticks, and pipes. The powerful **talons** were used as fishhooks.

Native Americans have joined in the fight to protect the bald eagle and no longer harvest eagle feathers. Instead, a law entitles Indian religious leaders first right to feathers of eagles that have died from accidents or natural causes.



Eagle Symbolism

United States History

The eagle was selected for the Great Seal in 1782 to symbolize Congress as the symbol of supreme power and authority. Although the Great Seal is not the first item to feature an eagle as a symbol, it was the first to use the American bald eagle species.

Military units have used the bald eagle in many ways to symbolize strength, courage and fierceness. During the Civil War, a Wisconsin regiment had an eagle called "Old Abe"--named after President Lincoln--as a mascot. During World War II, a U.S. Air Force squadron called "The Screaming Eagles" became well known for bravery against the enemy.

The bald eagle has also been used on U.S. money. In 1932, the eagle was put on the back of the George Washington quarter. It is now common to see eagles representing companies and businesses in their signs and logos.



World History

Eagles have been used as symbols throughout both the world and in history. An eagle emblazoned the banner of the ancient Roman Empire from 27 B.C. to A.D. 1453 and that of the German countries of Europe, collectively called the Holy Roman Empire, from A.D. 962 to 1806.

European military uniforms and insignia of the past two hundred years were adorned with eagles made of white, bronze, and gold metals. Perhaps the best modern example of this ornamentation was the three-dimensional, gold-crowned, sculpted eagle that perched atop the helmet of Kaiser Wilhelm II. The eagle is still the national symbol of many European countries.



Protecting Our National Symbol

Objectives:

- 1) List which activities of humans have caused a decline in eagle populations.
- 2) List activities of humans which help eagle populations.
- 3) Discuss what you can do to help eagles.
- 4) Discuss how eagles are being protected.



Laws Protecting Eagles

Endangered Species Act

At one time the Bald Eagle was endangered in all but 5 of the lower 48 states including Illinois and Iowa. In the other 5 states (Wisconsin, Minnesota, Michigan, Oregon, and Washington) it was listed as threatened.

Penalties: up to \$20,000 and/or 1 year in prison if found with any part of an **endangered species**.

Endangered Species Act also authorizes **habitat** protection and funding. Populations have since recovered and stabilized, so the species was removed from the U.S. federal government's list of **endangered species** and transferred to the list of threatened species on July 12, 1995, and was removed from the list completely in the lower 48 States on June 28, 2007. It is still protected under several other US regulations.

Bald and Golden Eagle Protection Act

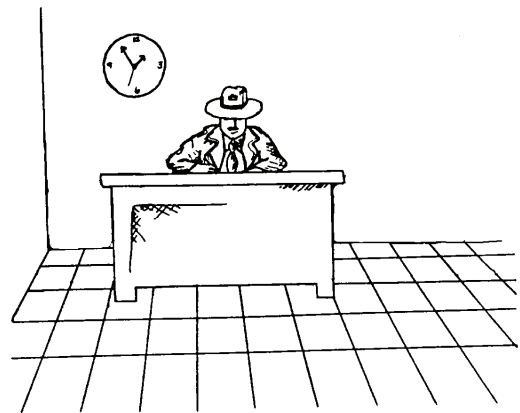
The bald eagle will continue to be protected by the Bald and Golden Eagle Protection Act even though it has been delisted under the **Endangered Species Act**. This law, originally passed in 1940, provides for the protection of the bald eagle and the golden eagle by prohibiting the take, possession, sale, purchase, barter, offer to sell, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. The 1972 amendments increased civil penalties for violating provisions of the Act to a maximum fine of \$5,000 or one year imprisonment with \$10,000 or not more than two years in prison for a second conviction.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests except as authorized under a valid permit. Additionally, the MBTA authorizes and directs the Secretary of the Interior to determine if, and by what means, the take of migratory birds should be allowed and to adopt suitable regulations permitting and governing take (for example, hunting seasons for ducks and geese). Penalties under the MBTA include a maximum of two years imprisonment and \$250,000 fine for a felony conviction and six months imprisonment or \$5,000 fine for a misdemeanor conviction.

Lacey Act

The Lacey Act was passed in 1900, and protects bald eagles by making it a Federal offense to take, possess, transport, sell, import, or export their nests, eggs and parts that are taken in violation of any state, tribal or U.S. law. It also prohibits false records, labels, or identification of wildlife shipped, prohibits importation of injurious species and prohibits shipment of fish or wildlife in an inhumane manner. Penalties include a maximum of five years and \$250,000 fine for felony convictions and a maximum \$10,000 fine for civil violations.





Winter Eagle Watching

Bald eagles are sensitive to human disturbance. When viewing eagles take care not to disturb them. Disturbance could mean a missed meal which might mean not enough energy to maintain body temperature through a cold night.

Eagle Etiquette



Eagle watching in the winter is a great way to observe our national symbol in action. Following some simple guidelines will allow you to view them with minimal impact.



- ◆ Stay in your car!
- ◆ In your car keep a distance of 100 yards.
- ◆ On foot keep a distance of 300 yards.
- ◆ Viewing with spotting scopes or binoculars works great!

As temperatures fall in the north, many eagles find themselves flying south in search of open water. Open water can be found on the Mississippi River in various places such as dams, power plants and where rivers converge. The turbulent water at all three locations prevents water from freezing and almost assures a meal for the birds.

December through February are the best months to spot an eagle near open water. Mornings are usually more productive when viewing around the dams, but eagles can be found during the day in the surrounding countryside where they search for **carriion**. Later in the afternoon, eagles begin returning to their favorite roosting area, usually in a valley or ravine which shelters them from the bitter winter winds. Never enter a roost at night!

As soon as the northern lakes thaw most eagles return north to begin nesting.



Eagle Rehabilitation

There is help for injured eagles.

Every year, hundreds of **raptors** suffer from injuries and illnesses that make it impossible for them to survive in the wild. Without medical attention, many of these birds would perish.

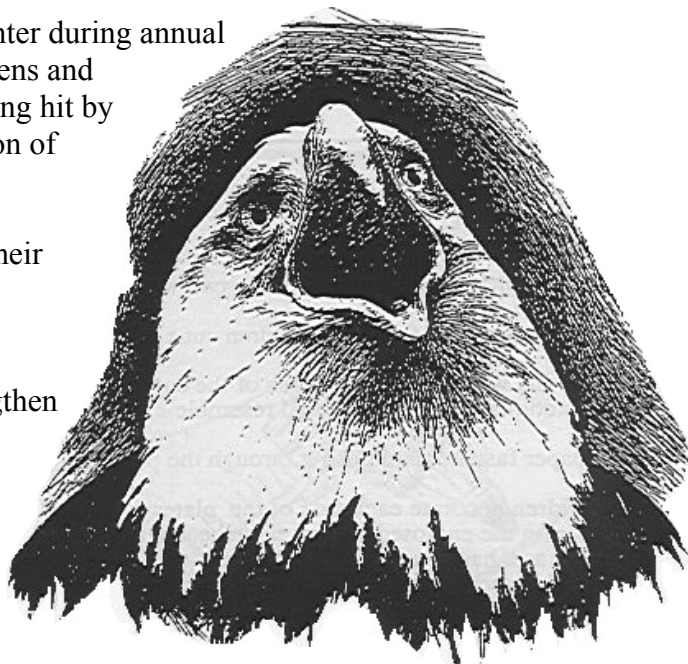
Established in 1974, The **Raptor** Center at the University of Minnesota College of Veterinary Medicine specializes in the medical care, rehabilitation, conservation, and study of eagles, hawks, owls, and falcons. In addition to treating more than 800 birds a year, the **Raptor** Center provides veterinarians from around the world training in **raptor** medicine and surgery. The **Raptor** Center reaches more than 250,000 people each year through public education programs and events that identify emerging issues related to **raptor** health and populations.

Another location where **raptors** and other birds are treated is the World Bird Sanctuary (WBS). The World Bird Sanctuary is both a unique St. Louis attraction and entertaining environmental education opportunity. With over 305 acres and over 200 animals in their care, they offer a one-of-a-kind wildlife experience. The World Bird Sanctuary's mission is to preserve the earth's biological diversity and to secure the future of threatened bird species in their natural environments. They work to fulfill that mission through education, captive breeding, field studies and rehabilitation. The World Bird Sanctuary is one of North America's largest facilities for the conservation of birds. WBS is on the leading edge of public awareness regarding the plight of bird species worldwide.

Most "patients" arrive at these facilities in the fall and winter during annual **migrations** season. They are collected by concerned citizens and wildlife managers. Causes of injury include shooting, being hit by cars, trap injuries, collisions with power lines, and ingestion of poisonous chemicals in the environment.

The birds are checked each day to determine changes in their condition and to re-bandage wounds if needed.

After treatment and before release, each **raptor** goes through a conditioning program. Daily flights help strengthen the wing muscles. Staff monitor their progress. Full recovery averages 8-10 weeks and then the birds can be released into the wild. Some birds never reach full recovery and cannot be returned to the wild, but instead help **raptor** centers and zoos educate people about the importance of the species.



Check out these websites for more information on **raptor** rehabilitation.

www.raptor.cvm.umn.edu and www.worldbirdsanctuary.org



You Can Make a Difference

Ultimately, the protection of a species relies on the preservation of its habitat.

The **habitat** for many plants and animals may be protected in several ways. If the land is owned by federal, state or local governments restrictions may be placed on its use.

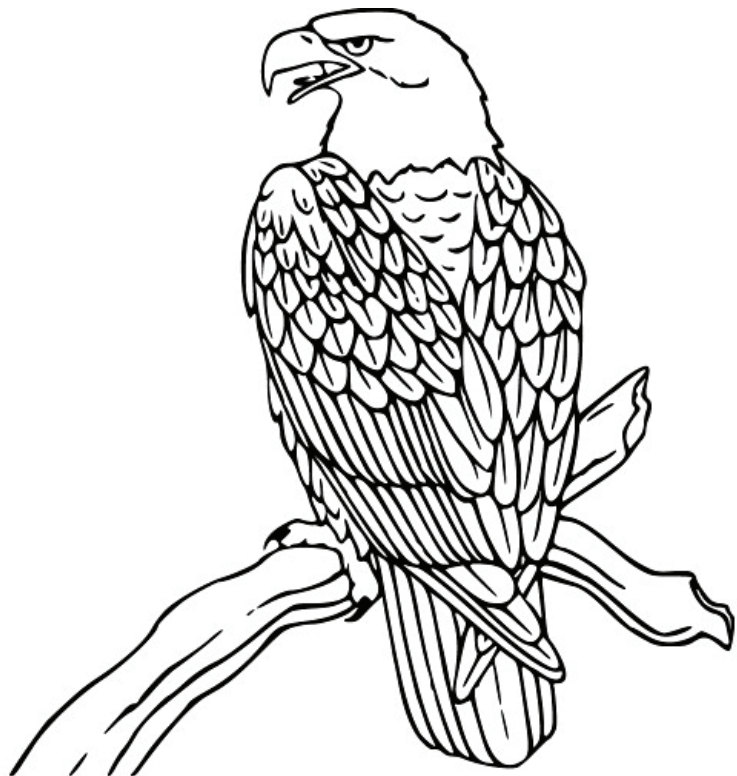
Bald eagle nests on state owned lands and in National Forests are protected by buffer zones and rules which restrict human use of the areas during nesting season.

Private land owners are also encouraged to manage their land for the benefit of the wild species which live there.

When a plant or animal's **habitat** is not properly protected and cared for it directly affects the species that live there. Plants and animals can both be placed on the **endangered species** list. If a species becomes **extinct**, it is will never return and the diversity of the earth is diminished.

Actions speak louder than words.

- Don't pollute. Keep the environment clean.
- Educate yourself and others about bald eagles.
- Become involved. Let your voice be heard.
- Write letters to elected officials.
- Report nest locations to local Department of Natural Resources or **Fish and Wildlife** officials.
- Report people who are harming or disturbing eagles.
- Avoid disturbing nests between February 15 and August 1.





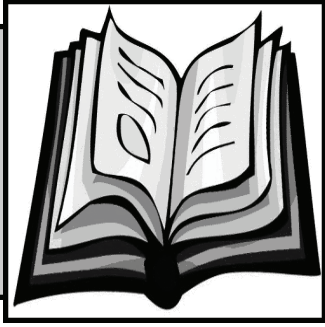
What You Can Do

The National Wildlife Federation says, "To learn the facts and make your views known in every forum available."

“Do's and Don'ts” to saving bald eagles

- 1) Never attempt to rehabilitate a **raptor** on your own.
- 2) Do not feed an injured eagle. The dietary needs of **raptors** are more delicately balanced than many people realize. The best steak will not provide an eagle with what it needs to survive.
- 3) **Raptors** perceive people as threats. An injured **raptor** is potentially dangerous. If you discover an injured eagle, handle it only if absolutely necessary.
- 4) Notify the **U.S. Fish and Wildlife Service (USFWS)** or your state's **Department of Natural Resources** if you find a dead or wounded eagle. Agents from the USFWS will take injured **raptors** to rehabilitation centers where the birds can be treated and released.
- 5) If you witness or acquire evidence concerning the shooting of an eagle, notify the **U.S. Fish and Wildlife Service** or state conservation officer so the individual can be apprehended and prosecuted.
- 6) Remember it is a violation of federal law to kill eagles, hawks, falcons, and other birds of prey. It is a federal offense to disturb an eagle nest.
- 7) Join a group that actively promotes and protects eagles.





Other Activities

1. Develop a bulletin board of current events relating to bald eagles. Have students clip newspaper and magazine articles which feature eagles and their **habitat**.
2. Show videos or have a local agency present a program to your class featuring bald eagles. The Corps of Engineers also offers free educational programs about the Bald Eagle, contact a ranger office near you. In the Quad Cities area you can contact the Mississippi River Visitor Center at 309-794-5338.
3. Have students define the following words: rehabilitation, **extinct**, endangered, threatened and **DDT**.
4. Ask students what is the greatest threat to the bald eagle. Have students look into a hand mirror.
5. Have students research methods used to increase bald eagle populations in Illinois, Iowa or Missouri and in other states (captive breeding, **habitat** protection, laws and law enforcement, and education programs). Discuss the feasibility of each technique comparing cost effectiveness, public acceptance, biological success and long term versus short term results.
6. Discuss why **DDT** is banned in the United States yet is still produced and sold to other countries such as Africa and Mexico. Also discuss what effect could chemical usage in these countries have on the wildlife and environment of North America.
7. Illustrate the concept of chemical buildup. Take a glass jar and fill it with water. Have participants drop marbles or rocks, which represent sedimentation, one by one into the water. Then put oil in to represent an oil spill to represent chemical pollution. Soon the water will be displaced representing sedimentation and contamination.
8. Investigate the Illinois, Iowa or Missouri state symbols or national symbols (state seal, flag, bird, fish, flower, tree, mammal, fossil, song, motto etc.). Have students define the word symbol, explain what a symbol represents, and how it affects society? Finally, list things which are symbolized by eagles (sports teams, towns).
9. Debate: Ben Franklin felt the wild turkey rather than the bald eagle should have been our national symbol. He felt the eagle "did not get its living honestly." However, primarily due to John Adams and Thomas Jefferson, the bald eagle was chosen--a "free spirit, high soaring and courageous symbol." Examine the natural history of both the wild turkey and bald eagle and decide whether Ben Franklin was correct in his opinion. Discuss what **characteristics** wild turkeys have that would make them a good national symbol. (Alaska State Museum Teachers Manual.)



Other Activities

10. Research the following laws; The **Endangered Species** Act 1973, The Bald Eagle Protection Act 1940, The Migratory Bird Act 1918, and The Lacey Act 1900. Discuss what events and factors led to this legislation and how it was produced, whether the laws are fulfilling their intent, and if additional laws are needed or existing laws need strengthening.
11. Take a field trip to a local or regional **raptor** rehabilitation clinic.
12. Discuss **habitat** requirements of the bald eagle and compare them to your home or school.
13. Using drawings in a field guide as models, trace silhouettes of various birds of prey - eagles, hawks, owls, vultures - on paper and cut them out. Display them on windows, ceiling, or class room walls. See how many **raptors** you can learn to identify by their silhouettes.
14. Cover a classroom wall with paper and give everyone in your group a chance to contribute to a mural depicting the life of an eagle, the history of our national symbol, or eagles of the world.
15. Have students research native legends and read a selection in class. Discuss how modern society views eagles compared to the Native American view point.
16. Learn about the ways that Native Americans honored eagles. Then build and paint miniature totem poles - made of clay, soap or paper mache - featuring eagles.
17. Create cartoon posters portraying important eagle facts or problems in humorous words and pictures. Display the posters and let the class judge the best.
18. Conduct a one day field trip to a nearby lock and dam, to see how many eagles are perched and looking for food.

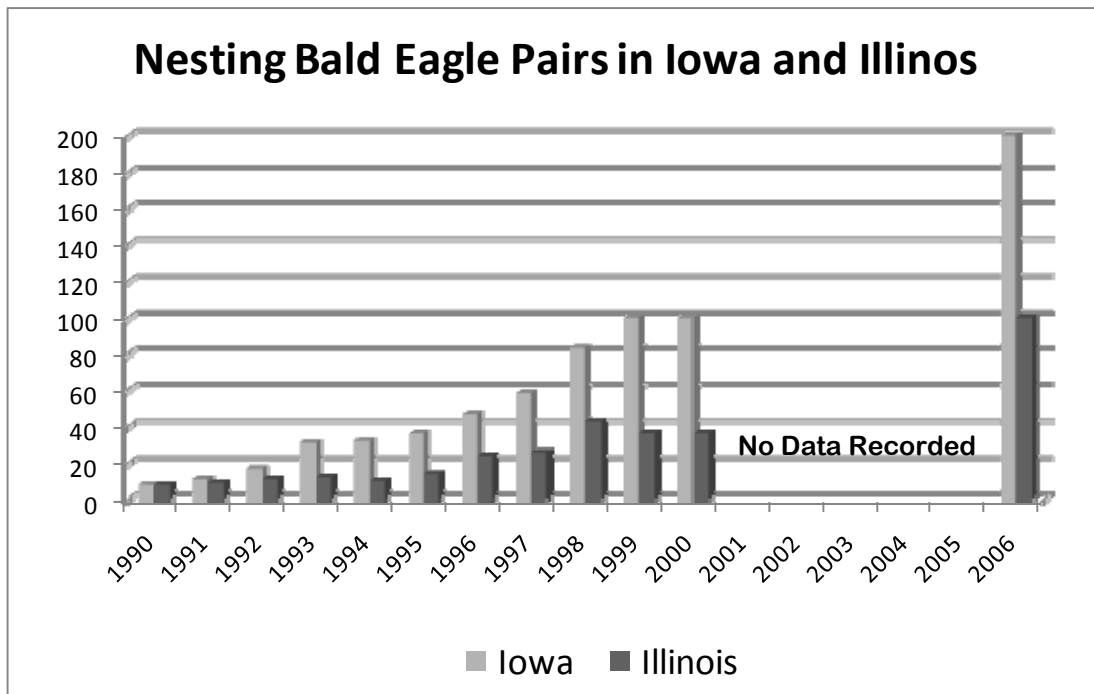


Glossary

Attribute	a quality or characteristic inherent in or ascribed to someone or something.
Carrion:	dead and decaying animal flesh.
Characteristic	a distinguishing quality.
DDT:	a chlorinated hydrocarbon insecticide. The sale of DDT in the U.S. was banned in 1972 due to its persistence in the environment and potential harm to wildlife and humans.
Department of Natural Resources:	a state agency in charge of enforcing certain fish and game laws.
Ecological niche:	the physical space (habitat) a plant or animal occupies and the role that organism plays in a natural community.
Endangered species:	an animal or plant species that is in danger of extinction throughout all or a significant portion of its range.
Extinct species:	an animal or plant species that has died out forever and will never reproduce again.
Fledgling:	a young bird that has the feathers needed to fly from its nest.
Food chain:	the transfer of food energy from one organism to another in a series of plants and animals that feed upon one another.
Habitat:	the specific natural environment (home) of an organism or group of organisms; provides water, food and shelter.
Migration:	a seasonal movement from one region to another.
Predator	an animal that lives by killing and eating other animals (prey).
Raptor	a predatory bird with talons adapted for seizing prey.
Reverse Sexual Dimorphism:	condition in many bird species where the female is larger than the male.
Talons:	the sharp claws of a bird of prey.
Territory:	area defended by an animal against others of its kind.
U.S. Fish and Wildlife Service:	a federal agency in charge of federal fish and game laws.
Wingspan:	the length of a bird's wings measured between the outermost tips.



Bald Eagle Nests in Iowa & Illinois



You will notice that between the years of 2001 and 2005 no data was recorded. The population of the Bald Eagle was doing so well after the year 2000 that most states did not find it necessary to conduct an annual count of the birds. In 2006 a count was made and populations were found to be so strong that it resulted in the species being removed from the federal threatened species list in 2007.





Classroom Activity

Build an Eagle Wing

A Bald Eagle has a wing span, tip to tip, of up to 7 feet (2.2 meters). Yet an average male Bald Eagle weighs about 9 pounds and an average female weighs about 12 pounds. (Try lifting a 10-pound sack of flour or sugar for comparison.) It is the combination of large wings and light weight that makes the eagles masters of the air.

You Need:

- Pattern on page 29/30
- Crayons, color pencils, or fine tip markers
- Scissors
- Paste or glue
- Two 3/4" brads, also called paper fasteners

Before Assembling:

Cut page 29 out of this guide. Color all the pieces. With the eagle wing pattern in front of you, read the following information about eagle flight anatomy. You will be told when to cut out the different pieces and how to assemble the wing step-by-step.

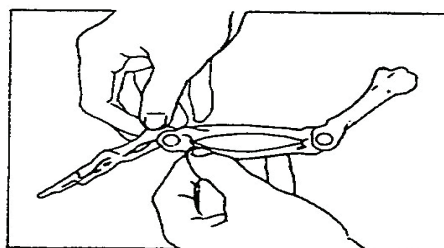
The Bones

The eagle's body, like that of most birds, is designed to be light.

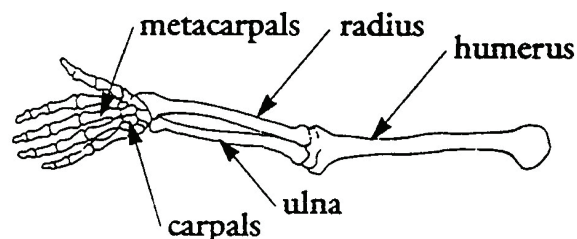
- The whole skeleton weighs less than the feathers!
- Many bones are hollow and porous. They may have struts inside for strength.
- Shoulder, rib, and wing bones are slender. The skull is thin, and there are no heavy teeth to weigh them down.

- Birds breathe oxygen from the air. In addition to lungs, birds have extra air sacs that extend into their hollow bones. Air sacs help with breathing. They keep the body light. Air sacs also serve as a cooling system. Flying can be hot work!

1. Cut out the bones from your eagle wing pattern along the dashed lines. Place area A of the humerus bone over area A of the radius and ulna bones and poke through the Xs with a brad. Place area B of the radius and ulna bones over area B of the carometacarpus and poke through the Xs with a brad.



The brads allow movement like the joints of a real wing. Compare the wing skeleton with the diagram of the human arm below.

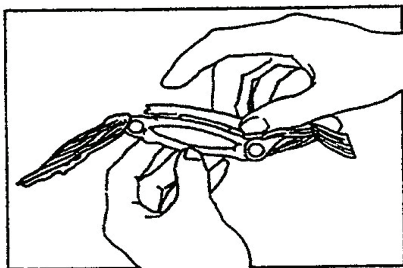




Classroom Activity

The Muscles

Breast muscles power the wings. If you could look at them, they would be dark in color. That shows they have a good blood supply, pumped by a strong heart, to bring oxygen to working muscles. Chicken breast (white meat) has poor blood supply. That's why chickens do not set long distance flying records!

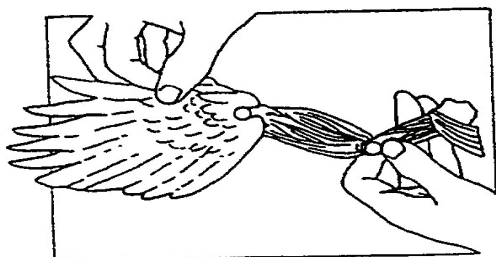


2. Cut out the muscles along the dashed lines. Place the muscles over the bones and fold the tabs to the back, matching the symbols. Paste the tabs so that you can lift the muscles up and still see the bones. Part of the humerus bone will still show.

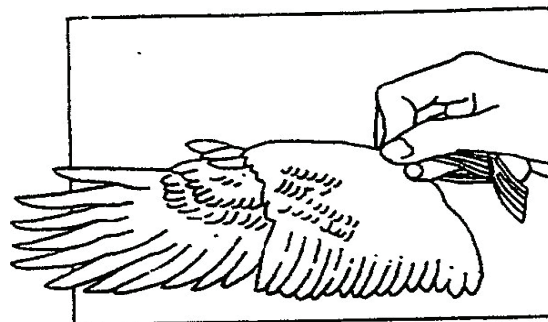
The Feathers

Feathers are made of keratin like your finger nails. They do not grow evenly all over a bird's body, but grow from special cells in feather tracts. (Look at a plucked chicken. Can you see rows of bumps? These mark the feather tracts.) Each cell grows the right kind of feather for that part of the body.

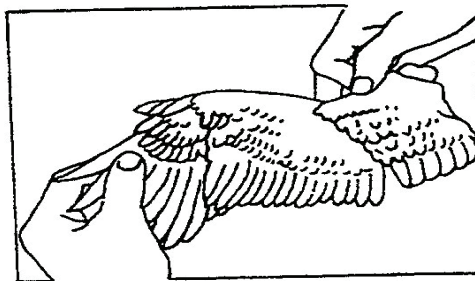
3. Cut out the feathers. Place the wing tip feathers called the primaries over the bones and muscles first. Note how the feathers fit around the brad. Fold the tabs behind and paste.



4. Next, place the secondary wing feathers over the lower arm muscles and bones. The right side will fit around the brad, and the left side should be allowed to overlap the primary feathers and hide the brad. Fold the tabs behind and paste.



5. The last group of feathers closest to-the body are called the tertials. Place them over the humerus bone and muscles. Allow the feathers to the left to cover the brad. The breast muscles and humerus bone will still show on the left side. Fold the tab over to the back and paste.

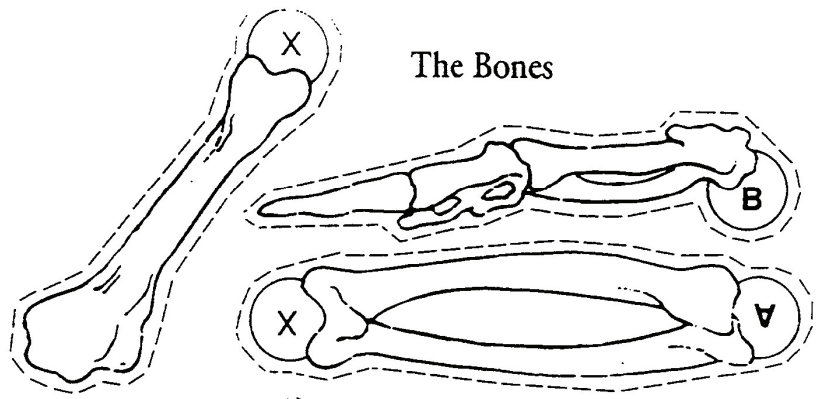


Now the eagle wing is complete. You can lift up the feathers to view the muscles and bones, and the brads allow you to observe how the wing is jointed.

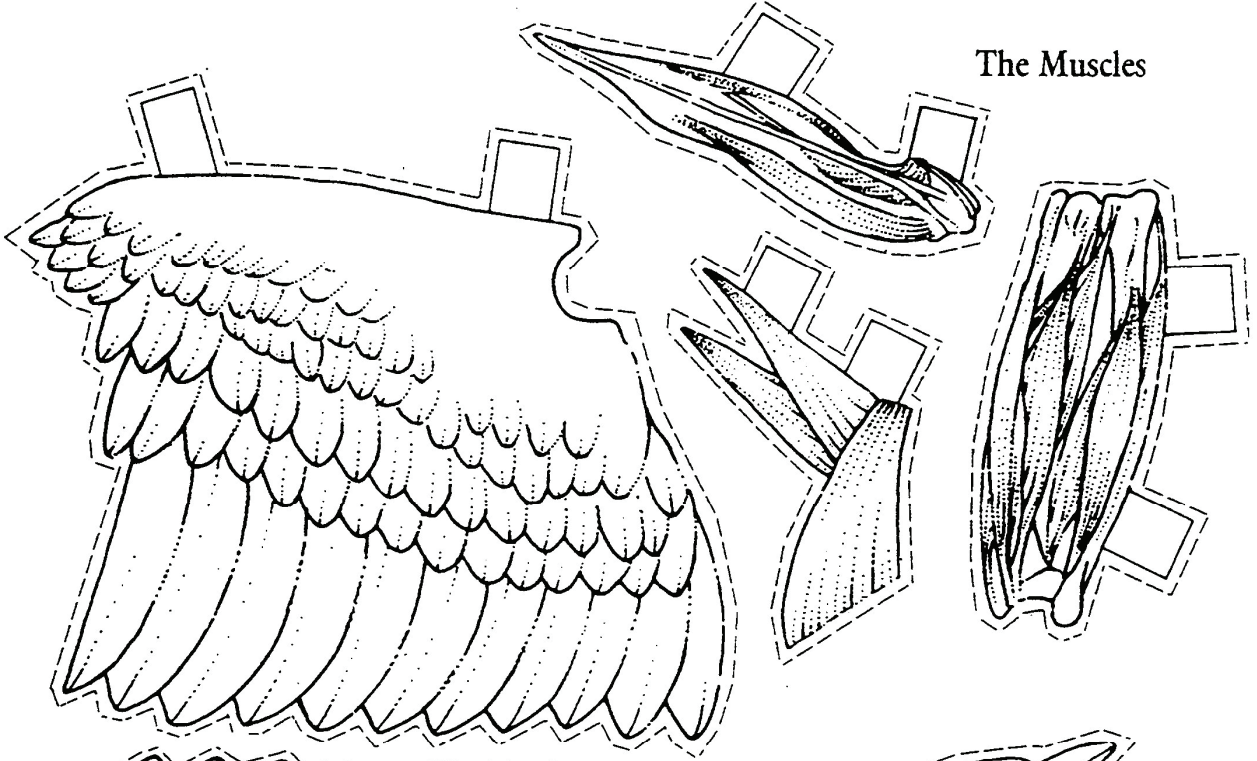
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Eagle Wing Pattern

Cut out this page, then follow the assembly directions on pages 27 and 28 to build an eagle wing .



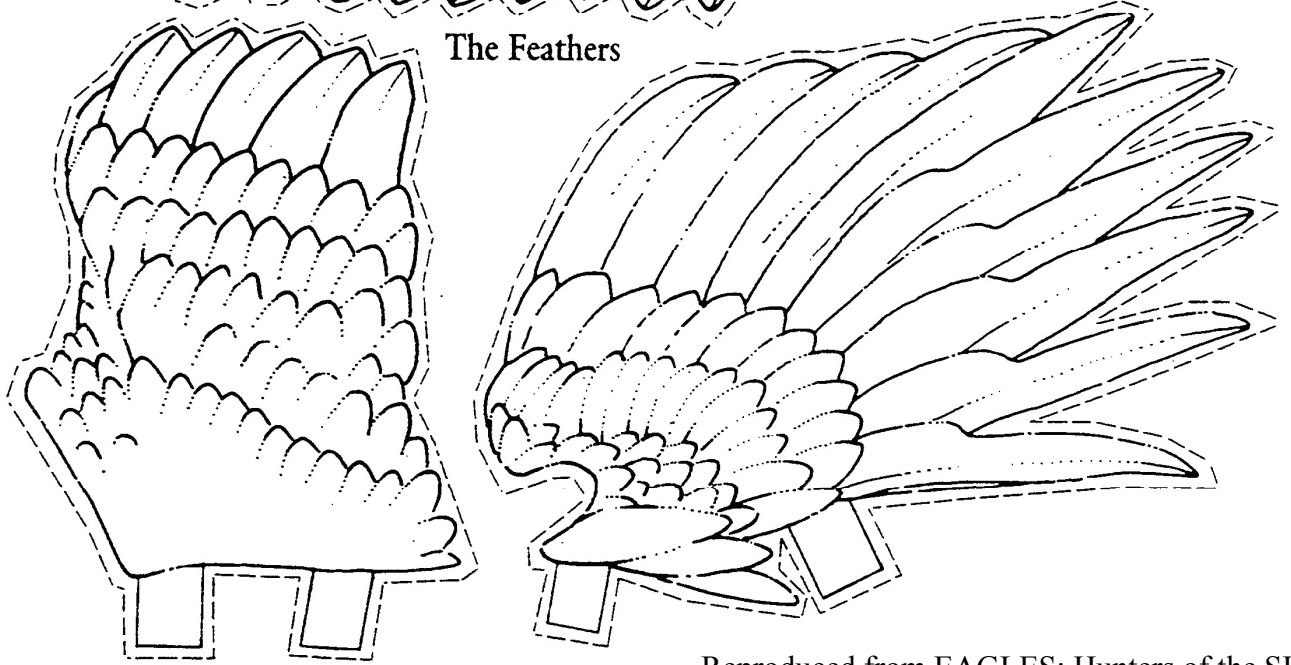
The Bones



The Muscles

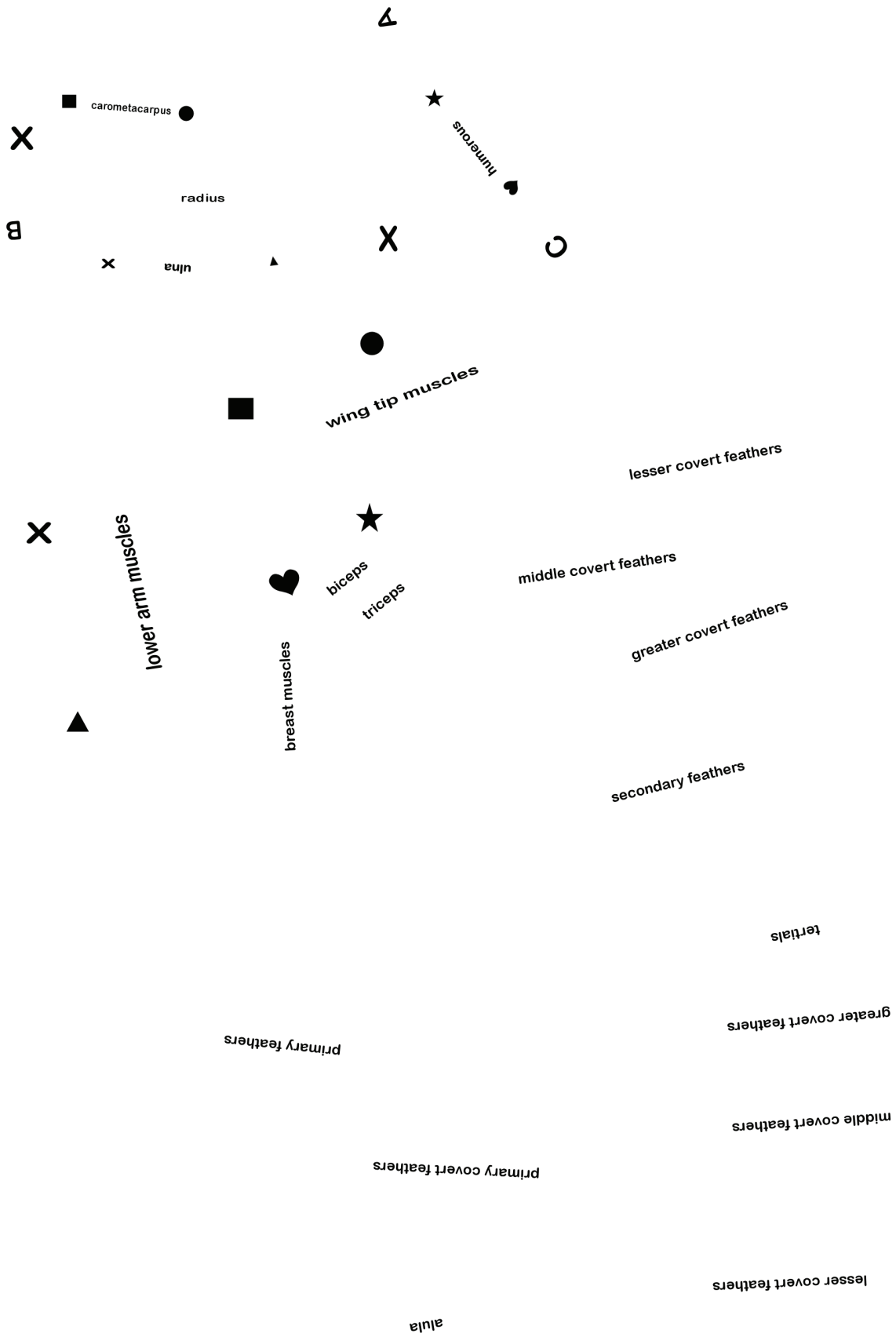


The Feathers



- Cut here to remove page from book -

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* Match symbols and letters to like symbols and letters



Word Search

ALERT

BALD EAGLE

BEAUTIFUL

BREED

CANADA

CLAWS

CONSERVATION

DARING

EATS FISH

ENDANGERED

FLIGHT

GOLDEN BROWN

GRACEFUL

GREAT SEAL

IDAHO

IOWA

KEEN VISION

LARGE

LUNGE

MATES

NESTS

PROTECTED

PROWESS

SOARS

SPECIES

STRONG

SWIFT

SYMBOL

TAIL

TALONS

TREETOPS

UNITED STATES

WHITE HEAD

WILDERNESS

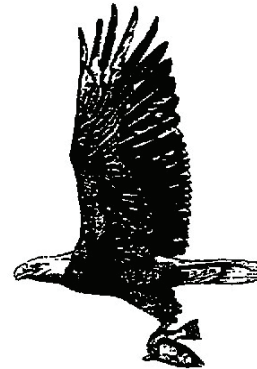
WINGSPAN

D	E	T	C	E	T	O	R	P	I	V	U	F	D	C	D	S	O
A	D	G	N	O	R	T	S	W	I	N	G	S	P	A	N	T	M
R	E	G	L	U	N	N	X	L	I	A	T	L	F	H	X	S	N
I	R	S	R	A	O	S	L	T	I	D	A	H	O	W	Y	E	N
N	E	D	G	O	L	D	E	N	B	R	O	W	N	M	R	N	D
G	G	J	E	R	V	D	F	R	G	V	H	N	B	S	M	N	O
G	N	L	W	E	S	H	D	E	V	I	Y	O	B	W	O	C	V
R	A	D	U	T	R	R	C	A	T	A	L	I	E	I	O	S	Y
E	D	E	A	N	F	B	S	E	V	F	T	B	S	U	P	S	C
A	N	T	L	U	G	I	H	S	L	U	F	I	T	U	A	E	B
T	E	M	I	G	S	E	W	U	E	S	V	T	O	U	Y	W	L
S	K	A	X	O	A	I	F	S	I	N	P	R	T	N	T	O	F
E	S	T	T	D	W	E	Z	A	E	O	R	E	H	A	F	R	W
A	V	E	D	S	C	A	D	E	W	L	E	E	C	N	M	P	A
L	A	S	W	A	F	A	K	L	O	A	A	T	D	I	H	L	V
M	L	A	R	N	N	I	R	A	A	T	O	O	R	L	E	Z	D
X	L	G	Q	A	D	X	S	F	D	B	W	P	H	R	I	S	K
C	S	U	C	F	L	I	G	H	T	R	E	S	T	A	L	W	J



Classroom Activity

Hazardous Links, Possible Solutions



Objectives

Students will (1) give examples of ways in which pesticides enter **food chains**, (2) describe possible consequences of pesticides entering **food chains**, and (3) describe how regulations attempt to control pesticide use.

Method

Students become hawks, shrews, and grasshoppers in a physical activity.

Materials

White and colored drinking straws; pipe cleaners; poker chips or multicolored dry dog food—30 pieces per student, two-thirds white or plain and one-third colored; one bag per grasshopper (approximately 18–20)

Background

Pesticides are chemicals often synthetic, inorganic compounds developed to control organisms that have been identified as “pests” under some conditions. Herbicides are pesticides that control unwanted plants; insecticides are pesticides that control nuisance insects and so on. Although pesticides are useful to humans when used properly, they frequently end up going where they are not wanted. Many toxic chemicals have a way of persisting in the environment and often become concentrated in unexpected and undesirable places from food and water supplies to wildlife and sometimes people, too. The process where chemicals accumulate in organisms in increasingly higher concentrations at successive trophic levels is called biomagnification.” Biomagnification results in the storage of such chemicals in organisms in higher concentrations than are normally found in the environment. The results can be far-reaching. For example, the insecticide dichlorodiphenyltrichloroethane (**DDT**) was applied to control insects that were damaging crops. In the early 1970s, it was discovered that **DDT** entered the **food chain** with damaging results. Fish ate insects that were sprayed by the chemical; hawks, eagles, and pelicans then ate the fish. The poison became concentrated in the birds systems, resulting in side effects such as thin egg shells. The weight of the adult bird would crush the egg in the nesting process. The impact on species, including the bald eagle and the brown pelican, has been well documented. Laws in the United States have now prohibited the use of **DDT**. However, **DDT** use is not prohibited worldwide. Resident and migrating animal populations in the countries that still allow the use of **DDT** are at particular risk. Even after the application of **DDT** is stopped, **DDT** and its by-products can affect the environment for decades.

Age: Grades 7–8

Subject Areas: Science, Expressive Arts, Environmental Education

Duration: two 30- to 45-minute sessions, with research time in between the two

Group Size: minimum of 10 students

Setting: a large playing area

Conceptual Framework Topic Reference: HIIIB4

Key Terms: pesticide, insecticide, herbicide, **food chain**, accumulate, toxic, chemicals, trade-offs, organic, inorganic, biomagnification

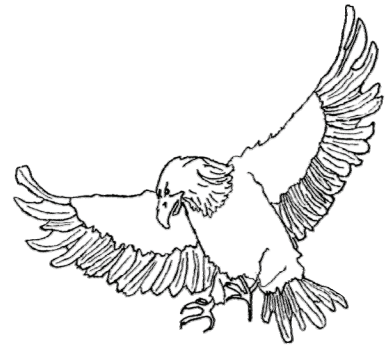
Appendices: Using Local Resources, Agencies and Organizations, Outdoors, Simulations

Background continued

Concerns over the growing use of pesticides led to the establishment of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) in 1972. FIFRA gives federal government control over pesticide sale, use, and distribution. Under FIFRA, the U.S. Environmental Protection Agency (EPA) gained authority to study pesticide use consequences and also to require pesticide registration by farmers, businesses, and soon. FIFRA later was amended to require pesticide users to take certification exams. EPA must register pesticides used in the United States. Congress also enacted the Toxic Substances Control Act (TSCA) in 1976 to regulate, test, and screen all chemicals imported or produced in the United States. TSCA requires that any chemical in the market place must be tested for toxic effects before commercial manufacture. TSCA also tracks and reports chemicals that pose health and environmental hazards. Authorization for toxic material cleanup has been placed under TSCA. TSCA supplements the Clean Air Act and the Toxic Release Inventory. Like FIFRA, TSCA is a balancing law, which says that the EPA is to make decisions on any chemical by comparing the risks it poses against the benefits it produces for firms and consumers. Public pressure continues to force changes in the application and availability of pesticides. For example, there now is growing interest in integrated pest management. This agricultural approach considers the entire farm and garden ecosystem. Integrated pest management can include using a pest's predator as well as other biological controls to reduce crop damage. Integrated pest management can include the selective use of naturally occurring and synthetic pesticides, as well as habitat manipulations. One concern with this approach is the possible introduction of non-native species. The major purpose of this activity is for students to recognize the possible consequences of accumulation of some pesticides in the environment and to evaluate measures to control pesticide use.

Procedure

1. Discuss the term “**food chain**” with the students. (**Food chain**: a sequence or “chain” of living things in a community, that is based on one member of the community eating another, and so forth [e.g., grasshopper eats plants like corn, shrews eat grasshoppers, hawks eat shrews])
2. Divide the group into three teams. In a class of 26 students, there would be 2 “hawks,” 6 “shrews”, and 18 “grasshoppers.” (This activity works best with approximately three times as many shrews as hawks and three times as many grasshoppers as shrews.) **OPTIONAL**: Have grasshoppers, hawks, and shrews labeled so they can be identified easily. For example, a green cloth flag (tied around the arm) for grasshoppers, red bandannas for “red-tail hawks”, and a brown cloth flag (tied around the arm) or hats for shrews.
3. Distribute a small paper bag or other small container to each “grasshopper.” The container is to represent the “stomach” of the animal.
4. With the students’ eyes closed, or otherwise not watching where the food is placed, spread the white and colored straws (or whatever material used) around in a large open space. Outside on a playing field (if it is not windy) or on a gymnasium floor will work; a classroom will also work if chairs and tables or desks can be moved.
5. Give the students the following instructions: the grasshoppers are the first to go looking for food; the hawks and shrews are to sit quietly on the sidelines watching the grasshoppers. After all, the hawks and shrews are predators and are watching their prey. At a given signal, the grasshoppers are allowed to enter the area to collect as many food tokens as they can, placing the food tokens in their stomachs (the bags or other container). The grasshoppers have to move quickly to gather food. At the end of 30 seconds, the grasshoppers are to stop collecting food tokens.
6. Next, allow the shrews to hunt the grasshoppers. The hawks are still on the sidelines quietly watching the activity. The amount of time available to the shrews to hunt grasshoppers should take into account the size area in which you are working. In a classroom, 15 seconds may be enough time; on a large playing field, 60 seconds may be better. Each shrew should have time to catch one or more grasshoppers. Any grasshopper tagged or caught by the shrew must give its bag or container of food to the shrew and then sit on the sidelines.
7. Next, allow from 15 to 60 seconds (or whatever set time) for the hawks to hunt the shrews. The same rules follow. Any shrews still alive may hunt for grasshoppers. If a hawk catches a shrew, the hawk gets the food bag and the shrew goes to the sidelines. At the end of the designated time period, ask all students to come together in a circle, bringing whatever food bags they have with them.



Procedure continued

8. Ask students who have been “consumed” to identify what animal they are and what animal ate them. If they are wearing labels, this will be obvious. Next, ask any animals still alive to empty their food bags out onto the floor or on a piece of paper where they can count the number of food pieces they have. They should count the total number of white food pieces and total number of multicolored food pieces they have in their food sacks. List any grasshoppers and the total number of white and multicolored food pieces each has. List the number of shrews left and the number of white and multicolored pieces each has. Finally list the hawks and the number of white and multicolored food pieces each has.
9. Inform the students that there is something called a “pesticide” in the environment. This pesticide was sprayed onto the crop the grasshoppers were eating in order to prevent a lot of damage by the grasshoppers. If there were substantial crop damage by the grasshoppers, the farmers would have less of their crop to sell, and some people and domestic livestock might have less of that kind of food to eat—or it might cost more to buy the food because a smaller quantity was available. This pesticide accumulates in **food chains** and can stay in the environment a long time. In this activity, all multicolored food pieces represent the pesticide. All grasshoppers that were not eaten by shrews may now be considered dead if they have any multicolored food pieces in their food supply. Any shrews for which half or more of their food supply was multicolored pieces would also be considered dead from chemical side effects. The one hawk with the highest number of multicolored food pieces will not die. However, it has accumulated so much of the pesticide in its body that the egg shells produced by it and its mate during the next nesting season will be so thin that the eggs will not hatch successfully. The other hawks are not visibly affected at this time.
10. Talk with the students about what they just experienced in the activity. Ask for their observations about how the **food chain** seems to work and how toxic substances can enter the **food chain** with a variety of results. Introduce the term “biomagnification,” and discuss how it can result in the accumulation of chemicals in species higher in the **food chain**. The students may be able to give examples beyond those of the grasshopper—shrew—hawk **food chain** affected by the pesticide in this activity.
11. Divide the class into two, four, or more groups. Ask one or two groups of students to research other chemicals—such as tributyltin (TBT), polychlorinated biphenyls (PCBs), or dieldrin—that have demonstrated the ability to persist and accumulate through **food chains**. What are the effects of such chemicals on organisms? What limitations have been set on the use of such substances? Have the other groups research legislation such as FIFRA and TSCA to determine how these laws work to control toxic chemicals. Allow all groups to present their findings in class, and then have the students hypothesize the effectiveness of the laws in controlling the various chemicals that were researched.

Extensions

1. Consider and discuss possible reasons for use of such chemicals. What are some of the benefits? What are some of the consequences?
2. Offer and discuss possible alternatives to uses of such chemicals in instances where it seems the negative consequences outweigh the benefits. For example, some farmers are successfully using organic techniques (e.g., sprays of organic, nontoxic substances; crop rotation; companion planting); biological controls (e.g., predatory insects); and genetic approaches (e.g., releasing sterile male insects of the pest species) in efforts to minimize damages to their crops.
3. What research is being developed and tested on the effects of pest control efforts— from effects of possibly toxic chemicals to nontoxic alternatives? What are the benefits? Consequences? Potential?
4. Review news media for relevant local, national, or international examples of such issues.

Evaluation

1. Identify examples of how pesticides could enter a **food chain**.
2. Discuss two possible consequences of pesticides entering the **food chain** for each of the examples given above.
3. Evaluate the effectiveness of at least one law that regulates hazardous chemical usage.

Activity adapted from Project Wild and the Council for Environmental Education 2006



Resources

Books and Websites about Eagles

Mississippi River Project's Webpage: www.missriver.org

US Fish and Wildlife Service Rock Island Field Office. www.fws.gov/midwest/rockisland/

Beans, Bruce E. (1996) *Eagle's Plume: The Struggle to Preserve the Life and Haunts of America's Bald Eagle*. Scribner.

Bird, D.M. (ed.). (1983) *Biology and Management of Bald Eagle and Osprey*. Harpell Preess, Ste. Anne de Belevue, Que.

Brown, L. and D. Amadon. (1968) *Eagles, Hawks and Falcons of the World*. 2 vols. McGraw-Hill, New York.

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Gieck, Charlene. (1991) *Eagles for Kids*. Northword Press, Inc. Minocqua, WI.

Grossman, Mary Louise and John Hamlet. (1964) *Birds of Prey of the World*. Clarkson N. Potter, Inc., New York.

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Lloyd, G. and D. Lloyd. (1970) *Birds of Prey*. Grosset and Dunlap, New York.

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Parry, G. and R. Putnam. (1979) *Birds of Prey*. Simon and Schuster, New York.

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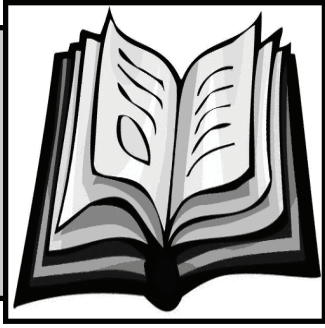
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Nature Scope is an environmental education activity series produced by the National Wildlife Federation, Washington, DC.

Zoobooks by various authors is a series of publications including *Birds of prey and Eagles*. Available from Wildlife Education, Ltd., 9820 Willow Creek Rd. Suite 300, San Diego, CA 92131.