

Crane Conservation: Studies in Crane Behavior, Genetic Diversity, and the Linkages between People and Cranes

Classroom and field trip activities
for grades 9-12

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Introduction

We're delighted that you are planning a field trip to the International Crane Foundation (ICF). This packet includes everything that you will need for a successful class trip, including field trip instructions, reference materials, student activity sheets, and post-field trip activities. The activities are designed to complement your field trip to ICF and focus on the central theme of crane conservation. Please review the instructions on the following pages to ensure that you, your students, and their chaperones get the most out of your visit to ICF.

The materials for teachers, chaperones, and students are organized separately. You have permission to make as many copies as necessary of these materials.

Please fill out the evaluation provided and return it to us—we're anxious to improve our materials, and your comments are very helpful. If you would like to involve your class in the evaluation, ask your students to write a letter to ICF, explaining what they liked or didn't like about the field trip. If you would prefer to email us, please address your correspondence to the Visitor Programs Coordinator at ed@savingcranes.org.

Again, thank you for visiting the International Crane Foundation!

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The success of any field trip depends on how well prepared you, your chaperones, and your students are. The more background information your students have, the more questions they will ask, and the more they will learn. While it is not necessary to do anything in this packet prior to coming, it is helpful for students to have a fundamental understanding of what they will see and for your chaperones to understand their responsibilities.

This packet supplies instruction sheets, reference materials, and student activity sheets for you to use in preparation for your field trip, as well as post-field trip activities to use after returning to your classroom. We have listed the student activities in a suggested order; however you may wish to rearrange the activities to accommodate your lesson plans. The student activities are divided into three units that may either be used separately in your natural and social science classes or, alternately, may be used together for an interdisciplinary study of cranes in your classroom.



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Student Activity Sheets (in pockets)



Unit 1: Crane Biology and Behavior

Unit 1 focuses on the topics of crane biology and the study of animal behavior. The activities are divided into two sections that may be easily incorporated either individually or as a complete unit into a variety of science classes.

Introduction to Cranes and Behavior

This section introduces students to general crane biology and the study of animal behavior, or ethology. The two handouts, "An Introduction to Cranes" and "Field Guide to Crane Behavior," provide the foundation for this unit and are important student resources. The final two activities, "Crane Life Cycle" and "Using the Old Cranium," may be used to review the key concepts of the unit.

- **An Introduction to Cranes**
- **Field Guide to Crane Behavior**
- **Ethology: The Study of Animal Behavior**
- **You be the Guide**
- **Crane Life Cycle**
- **Using the Old Cranium**

Discussion / Written Questions

Use this set of activities to guide an in-depth discussion of crane behaviors and their biological and environmental influences. The handouts may be used as follow-up activities after the students have completed their visit to ICF, as we have suggested, or be incorporated into the activities completed before the field trip to provide more in-depth preparation.

- **Bewildering Behaviors**
- **Ethological Elaborations**
- **Siberian and Sarus Cranes: Specialists vs. Generalists**
- **Siberian Crane Migration**
- **Sandhill Cranes: Learned Behavior**
- **Sandhill Crane Timeline**
- **That's Debatable**
- **What Happens Next?**



Unit 2: Conservation Biology and Genetics

Unit 2 focuses on the role of genetics and conservation biology in the management of captive wildlife populations. The activities are divided into two sections, with the second section designed to build upon the concepts introduced in the first set of activities.

Introduction to Captive Population Management

This section introduces students to the concept of captive population management and the importance of maintaining genetic diversity in wildlife populations. The activities introduce basic concepts of genetics and how genetic characteristics are inherited.

- **Wanted: Species Survival Plan Coordinator**
- **Where Did You Get Those Alleles?**
- **Captive Breeding: Maintaining Healthy Wildlife Populations**
- **Squared Away**

Genetic Inheritance and Inbreeding

Building on the activities in the first section, the following activities explore in more detail genetic inheritance and the danger of inbreeding in captive population management. The final three activities explore the potential impact of the loss of genetic diversity on the endangered whooping crane.

- **Too Close for Comfort: The Dangers of Inbreeding**
- **Genetic Diversity and Wildlife Populations**
- **Family Affair: Using Pedigrees to Manage Captive Populations**
- **Genetic Drift**
- **The Whooping Crane**

Unit 3: Cranes and People



Unit 3 introduces students to the role of cranes in human cultures.

The activities examine how both ancient and modern people have incorporated cranes into their daily lives through symbolism, music, dance, and myth. Through these topics, the activities also explore the larger theme of the relationship between humans and the natural environment.

The activities are divided into five sections representing the geographic areas where cranes are found. The final section, "Conservation Partnerships," explores the challenge of incorporating the needs of people and wildlife in the development of conservation projects. This section is designed to compliment the discussion of people and the natural environment outlined in the previous sections.

The activities are appropriate for Language Arts, Social Studies, Art, and Music classes.

North America

- Myth and Folklore
How Crane Got His Long Legs
- People and the Natural Environment
Whooping Cranes in the Red Earth Region

Asia

- Cranes for Peace
- Haiku
- Cranes and Music

Australia

- Myth and Folklore
Brolga, the Dancing Girl
- As Time Goes By...

Africa

- Myth and Folklore
Arap Sang and the Cranes

Europe

- A Snow Wreath?

Conservation Partnerships

- Cao Hai Nature Reserve

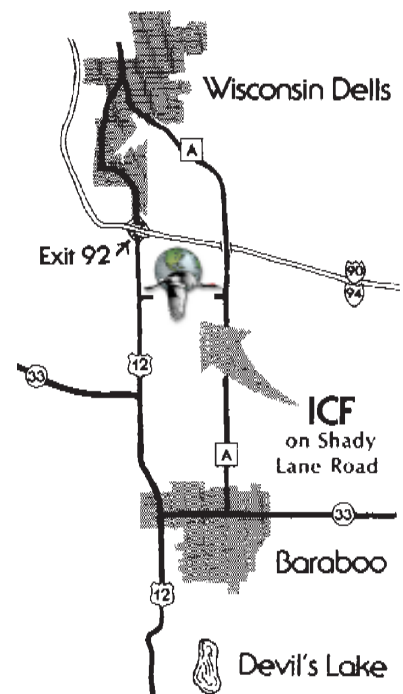
Teacher Instructions

Preparing for the field trip:

- *Brief students on the field trip. Students should be properly dressed for the weather. This includes comfortable shoes, raincoats, and warm clothing. **We will go outside even if it is raining.**
- *Collect admission fees from students.
- *Recruit as many chaperones as possible. Prior to the field trip, give each chaperone a copy of the "Chaperone Instructions" and "Introduction to Cranes."
- *If you have any questions about the activities or the field trip, please call the ICF Education Department at (608) 356-9462, ext. 127 and we will be happy to help you.

1. Arrival and Introduction

A map to ICF is located to the right. Have the bus drop your students off at the Cudahy Visitor Center before parking. Please plan on arriving 15 minutes prior to the start of your tour to organize your group and to allow time for a restroom break, if needed. Note that there are restrooms only at the Cudahy Visitor Center. An ICF Naturalist will greet you, show the students into the theater, and direct you to the Gift Shop where you can pay for the group. The Naturalist will welcome your class, show a short slide show, and brief everyone on the activities to follow. After the introduction, your class may be divided into two or more groups. Each group will be led by a Naturalist and will participate in all of the activities, though not necessarily in the same order.



2. Observing the Cranes / Behavior Study

The Naturalist will lead a discussion of all 15 species of crane that will be observed at the Wattled Crane Exhibit, Johnson Exhibit Pod, and Amoco Whooping Crane Exhibit (see site map). As an optional part of the tour, students may also participate in an on-site behavior study, using the activity "Ethnology: The Study of Animal Behavior."

3. Nature Trail

The Naturalist will lead the students on a short hike to view our on-site restoration work. At various stops, students will learn about the ecology of wetlands, prairies, and oak savanna ecosystems, their importance to cranes and other wildlife, how they have changed over time, and how ICF works to preserve or restore these ecosystems. Students will also view Crane City, our main breeding facility, from a distance.

4. Donnelley Family Education Center

Each group will visit the Donnelley Family Education Center to learn about raising crane chicks at ICF, and how we prepare young cranes for reintroduction into the wild. Other exhibits may also be featured during your visit to the Center.

Chaperone Instructions

Thank you for leading a group of students on this International Crane Foundation field trip!

Your involvement with the students is helping to foster stewardship and appreciation for our natural world that will last a lifetime. Your main responsibility will be to supervise your group. To help prepare for the trip, please obtain a copy of "An Introduction to Cranes" from the teacher and read it before the day of your visit. This introduction will allow you to answer questions that students commonly ask, but don't worry, we don't expect you to be an expert! You will probably learn a lot during the trip, too, so if you have questions about these magnificent birds or the places where they live, please ask!

We organize the field trip as follows:

An ICF Naturalist will welcome your group and show them into the auditorium. After a brief introduction and slide show, he or she may divide the class into smaller groups. Each group must have one or more chaperones. From the auditorium, each group will visit the following areas, though not necessarily in the same order.

1. **CRANE TOUR/ BEHAVIOR STUDY**

The Naturalist will lead your group to the Johnson Exhibit Pod, where you will see thirteen species of adult cranes. The two other species of cranes will be found at the Wattled Crane Exhibit and the Amoco Whooping Crane Exhibit. The Naturalist will lead the discussion on crane biology, current threats to cranes, the role of habitat protection in endangered species conservation, and ICF's work in crane conservation. As an optional part of the tour, students may also participate in an on-site behavior study, using the activity "Ethnology: The Study of Animal Behavior."

2. **NATURE TRAILS**

Exploring our nature trails gives students an opportunity to learn about the ecosystems that cranes use in the wild. The Naturalist will introduce your students to ICF's restored wetland, prairie, and oak savanna ecosystems, and will explain the importance of Crane City, our main breeding facility.

3. **DONNELLEY FAMILY EDUCATION CENTER**

Each group will visit the Donnelley Family Education Center to learn about raising crane chicks at ICF, and how we prepare young cranes for reintroduction into the wild. Other exhibits may also be featured during your visit to the Center. An ICF Naturalist will lead the discussion.

When finished with the tour, the Naturalist will ask for final questions and then lead your group back to the Cudahy Visitor Center. If your students plan on shopping, please do not allow more than 10 students in the shop at one time. Please help supervise students in the Gift Shop after the tour.

We hope you enjoy being a chaperone, and **THANK YOU** for volunteering!
HAVE FUN ON YOUR TOUR!

An Introduction to Cranes

Cranes are one of the most vulnerable families of birds in the world, with ten of the fifteen species considered threatened or endangered. The two species of cranes in North America demonstrate the range of population sizes: over half a million sandhill cranes live here, while fewer than 300 whooping cranes survive in the wild. Sandhill cranes are considered to be one of the oldest known living species of bird, with fossil evidence showing sandhill cranes in North America almost ten million years ago. Of the seven continents, only South America and Antarctica lack cranes.

Hérons, storks, and spoonbills also have long legs, necks, and bills and look similar to cranes, but are not closely related. Rather, the different families have evolved similar adaptations to a common wetland habitat. In actuality, the smaller coots, rails, and limpkins are the closest relatives to cranes.

Individual and Social Behavior

Cranes pursue each other, or small prey, by running. A running crane takes one to three steps per second and may extend its wings for more speed or balance. While ungainly looking, cranes can outrun a human. All cranes can swim, but adults usually avoid it unless necessary. Chicks are active a few hours after hatching, and must swim if they are to follow their parents, since most cranes nest in wetlands.

Feathers give cranes both the ability to fly and to regulate their temperature. Made of the same material as human fingernails and hair, feathers require constant attention. A crane preens by nibbling the base of a feather and then drawing it through the bill. This is particularly true for the large flight feathers. Feathers are replaced during a seasonal molt, when old feathers are pushed out by emerging new feathers. Most species of crane are flightless during this period, and usually molt during chick-rearing. It is not unusual for flightless cranes to stay near heavy cover until they and their young can fly.

When preening, cranes smear their feathers with oil from an oil gland located on the upper side of the tail. Contrary to previous belief, the oil does not serve as waterproofing, but helps condition the feathers and may have fungicidal and antibacterial properties. Prolonged preening follows water or dust bathing.

Some sandhill cranes also "paint" themselves by preening mud into their feathers prior to the breeding season. Painting is an important camouflage tactic that helps sandhill cranes hide amid the brown vegetation in a springtime marsh. Siberian cranes also paint themselves near the base of the neck as part of a breeding ritual.

Displays and Vocalizations

Cranes are aggressive birds. When fighting, they leap into the air to rake opponents with their sharp claws. This continues until one bird runs or flies away. But fighting is dangerous, so cranes have developed a complex system of warning behaviors to prevent combat.

Communication with other cranes includes physical postures and vocalizations. Crouch threats, ruffle threats, drop-wing threats, and flight intention postures are some of the behaviors you may see during your visit to ICF. Most crane species use a red patch of skin on the head as a warning display. Cranes can pump extra blood to the patch, turning it a bright crimson, and then point the patch at an invader or opponent.

The contact call is a soft, purring call made by adult cranes. This call alerts other cranes to the caller's whereabouts. The young have a high-pitched, peeping contact call. Chick distress calls are louder than their contact call, and parents react quickly to them. Beyond an age of about three months, chicks are able to perform the guard call, a single loud call that warns other cranes of danger.

The most significant vocalization is the "unison call." A pair gives the unison call together either to form and strengthen pair bonds or to enforce territory boundaries. In many species, the female has a two-note call while the male has a single-note call. Males of some species, such as the white-naped crane, Siberian crane, and brolga, may flex their wings while unison calling. Members of a pair usually stand within a few feet of each other while unison calling.

A unique call made by the grey crowned cranes is "booming." The birds use their gular sacs to develop resonance. The gular sacs are the small red pouches hanging below their chins. Crowned cranes also use a "quack" call to locate their mates.

Flight and Migration

Cranes typically run into the wind to achieve the speed necessary for flight. Cranes may fly as fast as fifty two m.p.h. without a helping wind during level, flapping flight. When soaring in thermals (updrafts of warm air), cranes will circle until they reach a desired altitude, usually between 3,000 and 5,000 feet. They then leave the thermal and glide forward while losing altitude. Next, they find another thermal and repeat the procedure. Some species, though, fly much higher to clear mountain ranges.

Flapping flight is an energy-intensive activity. Although soaring in thermals is slower than level flapping flight, it conserves energy. Cranes usually spend two days feeding for every day they fly during migration. Daily flights may range from a few miles in bad weather to several hundred miles if suitable stopover points are unavailable. Cranes also fly further on days when there are favorable winds. Cranes begin their migration in families or small groups. As migration progresses, however, groups join to form flocks of up to several thousand birds.

At night, migrating cranes roost at "staging areas" in water that is deep enough to cover their toes. Staging areas consist of safe roosting sites in shallow marshes or on submerged sandbars in rivers. There are usually good foraging areas within a short flight of the roosting sites. Examples of staging areas used by sandhill cranes include the Platte River (Nebraska), Jasper-Pulaski State Wildlife Area (Indiana), and the Sandhill Wildlife Demonstration Area (Wisconsin).

Nesting and Reproduction

Cranes have low reproductive capabilities. A pair will produce only one or two chicks each year, but that production will continue through most of their twenty to thirty year life-span. Their survival strategy is the opposite of short-lived animals, like rabbits or mice, with high reproductive rates. Cranes typically do not begin breeding until three to four years of age, and some species, like the Siberian crane, may not nest until they are five to seven years old.

Cranes are territorial during the breeding season, with each pair defending an area in which it will attempt to raise young. Sandhill cranes may nest in areas of less than five acres, but the average territory size is larger than fifty acres. Larger crane species typically have larger territories. Territories will tend to be smaller in areas of abundant food, good nesting habitat, higher population densities, and little disturbance from predators or humans.

It takes a crane pair from one to seven days to build a nest. Once the female lays the eggs, the pair shares incubation duties. The "nest exchange," or switching of incubation duties, occurs about every two hours, giving both birds a chance to feed and exercise.

The time of hatching coincides with the emergence of insects that the young will feed on. This timing is particularly important for migratory cranes so the young can grow and gain enough size and strength to migrate before winter sets in. Timing of nesting is less important with non-migratory cranes.

Most species of crane lay two eggs, but usually only one chick survives. The chicks are aggressive and often fight until one is driven away from the family group or dies from lack of attention. The remaining chick then has the complete attention of both parents and has a very good chance of surviving, even when food is scarce.

Both parents feed the chicks, but the male usually feeds them first. The newly hatched chick may be offered small pieces of the egg shell. The rest of the shell may be eaten by the female or carried away and discarded. Both parents brood, or sit over, the young birds to protect them from cold and precipitation. Brooding is important, since the chick cannot control its body temperature for the first few days after hatching. The family may leave the nest a day after the second chick hatches, but return to the nest in the evening for several days. The young birds may beg for food by "bill-touching" with their parents.

Cranes as "Flagship" Species

Biological communities are a complex web of life, incorporating all the organisms that exist in an area. In many of these communities, cranes occupy one of the upper levels of the food pyramid. Since they are dependent upon so many other species below them, biologists consider cranes to be flagship species; the health of the crane population is often a good indicator of the health of the ecosystem as a whole. By working to protect cranes, we work to protect all the other community members which may not be as conspicuous or easily recognized.

Wetlands

Most of the world's crane species rely on wetlands for their survival. Within these complex ecosystems, cranes find the necessary resources to survive.

Feeding is one of a crane's most time consuming activities. In wetlands, food is abundant in many forms: seeds, small mammals and reptiles, eggs of other birds, insects and other invertebrates, such as worms, clams, and crayfish. In addition, cranes find valuable carbohydrates in the starchy tubers growing on the roots of many wetland plants. Cranes are well-adapted to such food sources, with long beaks and necks which allow them to probe deep into the water and muck of a wetland.

The tall vegetation of a shallow marsh also helps hide cranes from predators, especially while nesting. In deeper marshes, cranes build massive nests sometimes five to six feet across and high enough that the water doesn't touch the eggs. Often a "moat" forms around the nest because the cranes use so many of the nearby plants for constructing the nest. The standing water protects the birds, as the noise of splashing will alert the parents of an approaching threat.

Many other creatures also make their homes in the wetland community. It is estimated that over one third of all threatened or endangered species in the U.S. are found in wetlands. Mammals such as beavers, muskrats, rabbits, and deer depend on the food and shelter of wetlands, as do waterfowl and other migratory birds.

Humans, too, reap many benefits from wetlands. Wetlands are known to reduce or prevent flooding and remove pollutants and sediment from surface water. As a source of food for humans, wetlands provide spawning grounds for about 90% of the fish and shellfish harvested in the coastal U.S.

Despite these benefits, wetlands continue to decline throughout the world. Often considered only as useless waste areas, wetlands have been drained, filled, plowed, and developed. Their seasonal nature can make them difficult to identify, and many are destroyed during dry periods when it appears they are no longer functional. Yet in most cases, dry spells of a few months to a few years are natural, and do not reduce the value of the wetland.

Wisconsin retains only about 54% of its original wetlands. Since the 1800s, almost half of the wetlands in the contiguous U.S. have been destroyed, and approximately 300,000 additional acres are lost every year. Not only does this trend threaten the plants and animals which live in wetlands, but it also threatens human communities which rely on wetland processes.

Prairies

In addition to their reliance on wetlands, most cranes will also use upland areas for feeding. Demoiselle and blue cranes nest in upland areas, and show physical adaptations, such as their shorter bills, for feeding on insects and seed pods that they find there.

Prairies were common throughout the Midwest before Europeans settled here in the 1800s. Prairie communities host hundreds of species of grasses and flowers, which support many mammals, insects, and birds, including cranes.

Specifically adapted to survive the Midwest's extremes of temperature and moisture, prairie plants invest two-thirds of their growth underground. Roots may reach up to eighteen feet down in the soil to insure that the plant will be able to find water during times of drought. This deep root system is one reason why prairie soils were resistant to erosion before being cut by the plow. Ironically, the rich soils which prairies developed made them very attractive as farmland and pasture. In Wisconsin today, only 0.1% of the original two million acres of prairie remains.

Another factor in the decline of prairies has been the disappearance of the forces that sustain them. Fires periodically swept the landscape and removed woody vegetation. Large herbivores such as bison and elk also removed young trees by grazing and browsing. Both processes served to remove above-ground vegetation and return minerals to the soil where roots could gain access to them. Removal of fire, bison, and other large herbivores from Wisconsin allowed woody vegetation like sumac, cedar, and aspen to invade the prairies.

Oak Savanna

One tree that is able to survive the effects of fire is the bur oak. This tree has evolved a thick, corky bark, which insulates living tissue from the extreme heat of a wildfire. The resulting mosaic of open grown trees widely scattered over a landscape of grasses and flowers, called savanna, was once the dominant ecosystem in the lower half of the state, with over seven million acres present in 1840.

In this oak savanna setting, light conditions on the ground vary from open sun to complete shade. Both sun-loving prairie plants and shade-tolerant forest species will thrive in very close proximity. The result is an incredibly rich diversity of plant and animal life. Unfortunately, savannas are also extremely rare. Today, only 1,360 acres remain in Wisconsin.



Academic Standards

To assist you in planning your visit to the International Crane Foundation, we have compiled the following list of Wisconsin Model Academic Standards fulfilled by a field trip to our site and the completion of the provided student activities. An asterisk (*) next to the standard indicates that a field trip to our site aids in fulfilling the standard. All other standards require both a site visit AND completion of pre-visit and/or post visit student activities.

To assist you in identifying the activities that satisfy your classroom needs and goals, the standards that apply to each of the three units are identified separately. Note that the standards apply to the unit as a whole and do not apply to individual activities within the unit. The standards for Unit 1 are reproduced from *Nature Net's Guide to Wisconsin Model Academic Standards (Grade 12)*, which is also available on Nature Net's website at www.naturenet.com.

Unit 1: Crane Biology and Behavior

Environmental Education: A.12.1*, B₁.12.2*, B₁.12.4, B₁.12.5, B₁.12.7, B₁.12.9, B₂.12.3*, B₂.12.13, C.12.1*, C.12.3*, D.12.1, D.12.4, D.12.5

English: A.12.1, A.12.3, A.12.4, B.12.1, B.12.3, C.12.1, C.12.2, C.12.3, D.12.1, D.12.2

Mathematics: A.12.1-5, B.12.2, B.12.3, B.12.5, E.12.1, E.12.3, F.12.1, F.12.2

Science: A.12.2, A.12.5, A.12.7, B.12.3, B.12.4, C.12.6, C.12.7, E.12.4, F.12.5-8, G.12.1, H.12.5

Social Studies: A.12.12, B.12.17, C.12.1, C.12.11

Unit 2: Conservation Biology and Genetics

Environmental Education: A.12.1*, C.12.3*

English: A.12.1, A.12.4, D.12.1

Mathematics: A.12.1, A.12.2, A.12.3, A.12.5, B.12.2, B.12.5

Science: A.12.1, C.12.1, F.12.3, F.12.4, F.12.6

Social Studies: NA

Unit 3: Cranes and People

Environmental Education: A.8.1*, A.8.4, A.8.5, B₁.8.5*, B₁.8.9, B₁.8.10, B₂.8.1, B₂.8.4*

English: A.8.1, A.8.2, A.8.3, A.8.4, B.8.1, B.8.3, C.8.1, C.8.2, C.8.3, D.8.1, D.8.2., E.8.1, F.8.1

Mathematics: A.8.1, A.8.2, A.8.4

Science: B.8.1, B.8.2, B.8.4, B.8.6, E.8.6, F.8.8, F.8.10*, G.8.3

Social Studies: A.8.8, A.8.9, B.8.1, B.8.10, E.8.3, E.8.9, E.8.10, E.8.13, E.8.14

Activity Answers

Unit 1: Crane Biology and Behavior

Life Cycle Worksheet

The correct answers are: 1) c; 2) c; 3) b; 4) c; 5) b; 6) b; 7) b; 8) a; 9) e; 10) a.

Using the Old Cranium

- 1) It is believed that sandhill cranes preen mud into their feathers to better camouflage themselves in the brown spring vegetation.
- 2) Brooding is a behavior where adult birds sit and keep their chicks tucked between their body and one wing. Young chicks need to be brooded because they are not yet able to regulate their own body temperature. Thus, they are very vulnerable to cold or wet conditions.
- 3) Cranes prefer to glide during migrations because they can cover great distances while still using very little energy.
- 4) A crane may use a distraction display when a predator is threatening a chick. By attracting the predator's attention, the adult crane gives its chick an opportunity to hide.
- 5) Unison calls are most often heard in the spring. Used to drive other cranes away and to reinforce their pair bond, this call is most common when pairs are intensely defending their territories during the breeding season.
- 6) Wetlands are important to cranes because they provide food, water, nesting sites, and protection from predators.
- 7) Some behaviors which are almost always performed by a pair include: unison call, dancing, and copulation. Pairs may also forage, roost, nest-build, preen, and perform a number of threats together.
- 8) Fires and grazing are the two most important forces which sustain prairies and savannas.

You be the Guide

This exercise is designed as an introduction to interpretation, stimulating students to do their own research and presentations. You may assign each student or group of students a particular species or introduce the exercise as an extra credit project. We've provided some important conservation topics that relate to each of the species listed. In cases where students cannot find direct links between the topic and cranes, they should look for how the topic affects other endangered species.

An excellent resource for the project is the ICF website at www.savingcranes.org. The website includes information on each of the 15 crane species, as well as a link to the on-line book, [The Cranes: Status Survey and Conservation Action Plan](#). Additional suggested resources for the project are listed on the "Read On!" handout, including books on cranes and current periodicals.

You be the Guide cont.

Questions provided on the student activity sheet guide students in their research and preparing their presentation. Students may present their research as a short oral presentation in class, or elect to develop another presentation style, such as an informative poster, mock newspaper article, or even a short play or story.

Suggested related topics for each species:

Siberian crane	Loss of wetland habitat
white-naped crane	Adaptation to human disturbance
sarus crane	Effects of war on wildlife
whooping crane	Inbreeding
red-crowned crane	Crane symbolism in human cultures
broilga	Behavioral and physical adaptations to heat
blue crane	Conflicts between agriculture and wildlife
demoiselle crane	Migration and flight
hooded crane	External stimuli and breeding (hint: photoperiod and breeding cycle)
sandhill crane	History of sandhill cranes in Wisconsin
wattled crane	Wildlife conservation in Africa
black-necked crane	Wildlife conservation in China
Eurasian crane	Radiotelemetry studies
black crowned crane	International trade in endangered species
grey crowned crane	Conflict between wildlife and humans for resources

Discussion / Written Questions

The student discussion questions have no simple answers, but should stimulate thinking about crane behavior and its influence by biological and environmental factors.

Bewildering Behaviors

- 1) a. Using threat displays instead of fighting allows cranes to settle their differences without risk of injury to either the aggressor or the defender.
b. Some examples of other territorial animals include lions (roaring), primates (hooting), cats (spraying), and dogs (marking with urine).
- 2) Rotation helps warm the egg more evenly and prevents embryonic membranes from sticking to the shell.
- 3) Like other ground-nesting birds, crane chicks are very vulnerable to predation. It is advantageous for the chick to be able to leave the nest to hide from predators.
- 4) Quick imprinting allows crane chicks to recognize their parents if they become separated. When breeding cranes in captivity, we must be careful that the chicks do not imprint on humans.
- 5) Cranes become less territorial after their chicks can fly because they no longer need to depend on only the area around the nest to find food. After a chick fledges, the family group now has the option of flying to a more remote feeding area.
- 6) Brown or gray coloration helps camouflage the chick from predators.
- 7) In many bird species, the female incubates the eggs exclusively. A duller plumage helps protect her from predation while on the nest. In cranes, the male and female share incubation duties, and both genders have similar plumage. Also, some species of birds are polygamous: the male has several mates, and it is thought that his colorful plumage aids in attracting females. In contrast, cranes are typically monogamous, although recent research has shown that they may occasionally switch mates. It is still possible, however, that the more monogamous pair bonding in crane species may reduce the advantage of attractive plumage to male cranes.

Ethological Elaborations

- 1) Walking--threat walk; Preening--drop wing threat; Wing flapping--flap display or arch display; Feather ruffling--ruffle threat.
- 2) Each body structure can be used in a variety of threat and courtship behaviors. Examples of correct answers include: Beak--drop wing threat--pointed under wing facing the intruder; Neck Stripe--pre-copulation posture--female faces away from male and puts neck out; Inner wing feathers--threat walk--inner wing feathers are raised slightly; Red crown--flap display--red crown pointed at intruder.
- 3) Cranes use their wings in many behaviors because wings can help make the crane's body look bigger and more threatening or intimidating.
- 4) The red crown is often larger in the spring because cranes are more active in defending their territory during this season than at other times of the year.

Siberian and Sarus Cranes: Specialist vs Generalist Species

- 1) Because of their restricted diet, Siberian cranes can only live in areas with abundant wetlands. The more flexible feeding habits of the sarus cranes allow them to take advantage of upland areas as well, resulting in a much broader range than the Siberian crane.
- 2) Because cranes reproduce so slowly, it is very difficult for a population to replace birds which are lost due to predation, power line collisions, or hunting. Thus, uncontrolled hunting can decimate a crane population very quickly. Because they are not hunted, sarus cranes tend to be much more tolerant of people than Siberian cranes, and are often found in close proximity to human communities.
- 3) Small range, specialized feeding habits, hunting pressure, and slow reproduction all contribute to the Siberian crane's endangered status. In general, the more specialized an animal is, the more difficult it is for that animal to adjust to changing conditions. Thus, specialists have a greater risk of becoming endangered or extinct than do generalists. In addition, slow reproduction makes it difficult for some species to offset natural mortality. The increased mortality caused by hunting can be especially damaging to such a population.

Siberian Crane Migration

- 1) All three flocks breed in Russia. The western flock passes through Azerbaijan on its way to Iran, the central flock passes through Kazakhstan, Uzbekistan, Tajikistan, Afghanistan, and Pakistan before it reaches India, and the eastern flock sometimes passes through Mongolia en route to China.
- 2) Conflicts between nations make it more difficult for ICF to get people to cooperate to protect cranes.
- 3) The central flock passes through four major biomes: taiga, steppe, desert, and mixed forest. Since there is little food or water in the desert, they must pass over this area in one flight. Feeding habits vary according to what is available and what activity the cranes are preparing for after the end of their migration. In the early spring, when Russian wetlands are still frozen, Siberian cranes rely on animal matter, like lemmings and small rodents. This diet may also supply extra protein for egg-laying and chick growth through the spring and summer. For the remainder of the year, the Siberian cranes feed on wetland vegetation, like roots and tubers. The high carbohydrate content of these plants may help fuel their seasonal migrations.
- 4) Some of the landmarks Siberian cranes might use include: the Ural, Himalaya, or Stanovoy Mountains, the Caspian or Aral Sea, and the Volga or Chang Jiang (Yangtze) Rivers.
- 5) Siberian cranes face many potential threats during their migration, including loss of suitable wetland habitat along their migration route as a result of human development, hunting, and power line collisions. In addition, Siberian cranes are subject to changing and often hostile political conditions in the countries over which they migrate. Prolonged conflict may have a devastating affect on the wetland and grassland habitats used by the cranes, and the cranes may be injured or killed during conflicts.

Sandhill Cranes: Learned Behavior

- 1) Each of the observations suggests that sandhill cranes can learn new behaviors, such as nesting in smaller territories or feeding on corn in agricultural fields. Indeed, sometimes the cranes learn new behaviors very quickly, as they do when adjusting their feeding times in relation to human activity levels.
- 2) Behavior changes have allowed sandhill cranes both to adapt to and take advantage of increased human and agricultural pressures in Wisconsin. For example, increased human settlement has led to a decrease in suitable wetland habitat for nesting. However, cranes have adapted to this habitat shortage by learning to nest in smaller territories. Cranes have also learned to utilize new food sources introduced by agriculture, such as germinating corn in the spring and waste grain in harvested cornfields.
- 3) Feeding in cornfields is a new behavior, and it is doubtful that cranes fed at night prior to the arrival of farmers. In contrast, it is likely that cranes fed on beetles prior to European settlement. However, the beetles were probably found under buffalo dung, instead of cow manure. It is also probable that cranes nested in close proximity to other pairs prior to European settlement, before the population was quickly reduced by hunting and human disturbance. Since that time, with fewer birds in the flock, each pair has had the luxury of claiming a large territory. Now, as the sandhill population grows, pairs are again forced to nest near each other.

Sandhill Crane Timeline

- 1) The downward slope is most severe between 1890 and 1915. Hunting, disturbance, and wetland loss are three factors contributing to the decline.
- 2) The graph bottoms out near 1929.
- 3) The graph rises between 1929 and 2000. Some explanations include: crane hunting was made illegal in Wisconsin; wetland destruction was slowed; and sandhill cranes became better adapted to human practices and disturbance, including agriculture.
- 4) At some point, the graph will stop rising, as all the available habitat becomes filled with breeding pairs. If the amount of available habitat remains fairly constant, the graph will level off. If habitat continues to disappear, however, the graph will probably start to dip again. Other factors, like hunting and poaching, habitat conditions in the wintering areas, and predator populations can also affect how the graph continues. The crane population may also expand into portions of neighboring states to find suitable habitat and nesting areas.

Unit 2: Conservation Biology and Genetics

Squared Away

The punnet square to the right shows the different gene combinations resulting from two heterozygous parents.

Based on the punnet square, there is a 75% chance that the resulting offspring will have the dominant characteristic and a 25% chance that the offspring will have the recessive characteristic. (Note that 50% of the offspring will also be carriers for the recessive allele, although they do not express the recessive allele themselves.)

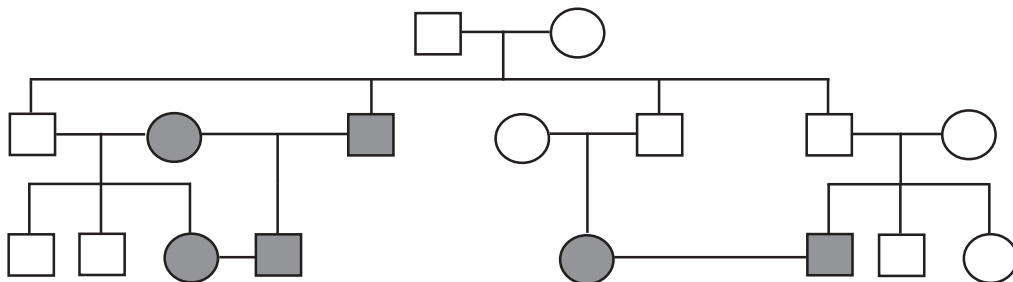
		Female Parent	
		D	d
Male Parent	D	DD	Dd
	d	Dd	dd

Too Close for Comfort: The Dangers of Inbreeding

Often, endangered species are confined to isolated geographic regions, or the total population of the species is very low. When a breeding population is small, there is a greater risk that closely related individuals will mate, increasing the chance that a recessive genetic disorder will be established in a population.

Family Affair: Using Pedigrees to Manage Captive Populations

1. Yes, the original male and female pair in the first generation are most likely carriers of the recessive genetic disorder. This is inferred from the presence of the genetic disorder in 2 of their offspring in the second generation - both individuals inherited one recessive allele from each parent.
2. Three examples of inbreeding are shaded in the pedigree below:



Unit 3: Cranes and People

Many of the activities within this section are exploratory in nature and allow for a variety of interpretations. We have included the following suggestions for selected activities to help guide class discussion and examination of the activity themes.

North America: People and the Natural Environment

Using the account of the history of whooping cranes near the Red Earth Indian Reserve in Saskatchewan, this activity examines how people learn about the natural environment through personal experience and observation, as well as the impact of humans on the natural landscape.

The account describes a historically close relationship between the Cree and the natural environment. This relationship is a result of direct observations and experience due, in part, to the Cree's traditional dependence upon their local natural resources for survival. Following are selected excerpts from the account that students may use in illustrating this relationship between the Cree and the environment.

- **Observation of crane habitat:** "they [whooping cranes] were walking in the water on the edge of the marsh;" "saw white cranes out on the prairies"
- **Observation of crane nesting behavior:** the nest was "just a few sticks on the ground in the swamp" with three eggs
- **Cree use of natural resources:** "My grandfather, Okimawipimotew, tried to kill them [whooping cranes]...He got very close but they flew before he shot;" "I was with a hunting party that was after moose on Kennedy Creek;" "he found three eggs in the nest and he took them to be eaten"

The account contains several possible clues as to why the whooping crane is no longer found in the region today. Students may cite hunting or egg collection as the most obvious possible cause. However, the account also refers to more subtle historical changes in the landscape that may have directly affected the whooping crane's habitat. For example, the following excerpts describe changes in the human landscape with the arrival of European settlers, and the resulting changes in the natural landscape as local land use practices changed in the region.

- "Miikwanaakeskam said he saw lots of white cranes **out on the prairies before the white man came.**"
- "My grandfather saw whooping cranes here a long time ago in the spring. They were walking in the water on the edge of the marsh. **That was before the willows grew up there.**"

Two factors that may have contributed to the growth of the willows in the marsh are fire suppression and soil erosion. Prairie fires set by lightning and Native Americans historically limited the growth of woody trees like willows, which may use up the water that feeds a wetland. With the arrival of European settlers in the Red Earth area, fire suppression may have resulted in the establishment of willows in the wetland. The second factor, soil erosion, may have resulted from changes in land use around the area, such as agriculture or cattle grazing introduced by the new settlers. Increased soil erosion into the wetland would encourage the establishment of larger shrubs and trees, such as willows. With the change in vegetation in the marsh, suitable habitat for the whooping cranes was reduced.

North America cont.

- "In the 1930s there was a big forest **fire**, which burned through the whole territory to the north of Red Earth. It came from the west, from the **farming settlement**, and it burned across Kennedy Creek and as far east as the Sipanok Channel. **After the fire we didn't see the whooping cranes anymore.**"

Fire suppression also leads to the accumulation of high fuel loads that, when a fire does start, can burn much hotter than normal. The resulting fire could destroy both crane nests and habitat, such as the vegetation near Kennedy Creek, that might otherwise recover from a fire.

Asia: Cranes as Symbols

This activity examines the characteristics and values that people identify with abstract symbols. People often choose birds as symbols because they represent certain characteristics, such as strength, intelligence, or beauty that we feel are important or valuable. For example, the bald eagle is equated with strength and courage, and, as the symbol of our country, it imparts these characteristics to the people of the United States.

Australia: Crane Dance

People may incorporate the crane dance into their cultures for a variety of reasons. They may admire the beautiful movements of the crane and naturally copy these motions in their dances. People may also copy crane dances because the birds have a special meaning to them, or they believe that by dancing like the crane they take on the spirit of the bird to perform special traditions or prepare for important events.

Africa: Arap Sang and the Cranes

The moral of "Arap Sang and the Cranes" is to think carefully before bestowing a gift upon a person. As Arap Sang laments at the end of the story,

"I'm old and I'm foolish," he said, "and I harm my friends. I had forgotten that men also were greedy and selfish and that they'll do anything for gold. Let me undo the wrong I have done by **giving without thought.**"

Europe: A Snow Wreath?

To the soldier in the poem "Cranes," the birds symbolize fellow soldiers lost in battle. This belief may stem from the meaning that the cranes hold for the soldier as both a pure and somewhat otherworldly creature. For example, the poem contrasts the white plumage of the Siberian crane with the soldiers who died in "bloody fight" - a gruesome death that is made pure by the symbolism of the white bird. The crane is also both a part of the soldier's world (the soldiers often see the cranes), as well as distant (the cranes are described flying in the sky far overhead). This contrasting view of the crane may reflect the feelings that he has for his fallen fellow soldiers, who are both close in his memories and very much removed in death.

Conservation Partnerships: Cao Hai Nature Reserve

1. The challenge of this activity is to design a project that balances the goals of both nature conservation and development within the reserve. To begin, it may be useful to have students draw up a list of what they perceive as the goals of both conservation and development within the reserve. For example, a goal of conservation may be to protect wetland habitat used by cranes and other waterfowl in the area, while a development goal for the villagers may be to ensure that each family has enough food for the whole year. As the students brainstorm ideas for a business, they can then evaluate whether their business will help achieve the goals that they have outlined for both conservation and development.

While developing their businesses, the students should also keep in mind that the standard of living of a typical villager at Cao Hai is very different from their own. Much of the villagers' daily activities focus on providing food and shelter for their families, and many of the material goods that we take for granted, such as a family car, telephone, or computer are not available to them. It may be useful to incorporate a discussion of these differences into the introduction of this activity to highlight some of the constraints that they will need to keep in mind while developing their business ideas.

To help the class generate ideas for their business, you can also discuss what businesses have been developed within the actual Cao Hai Nature Reserve. To date, over 400 small businesses have been started by small groups of villagers in the reserve. A large portion of the groups (over 200) have established small vending businesses to sell items, such as eggs, beans, or corn, on market day at Weining, a larger town located near the reserve. Other groups have raised livestock or poultry, started stove-making businesses using used oil barrels and iron sheets, repaired bicycles and radios, or offered paddle boat rides to tourists to view the area waterfowl. Weining, which is the largest town near the reserve, has served as a very important market for the villager's businesses, and many researchers feel that it has contributed to the success of the Cao Hai project.

2. The second activity builds on several of the themes developed in the previous role-playing activity. To begin the activity, divide the class into two groups, with one group representing the Cao Hai villagers and the other representing the Chinese government. Remind the students that as they develop their priority lists for the two groups, they have the challenge of viewing the reserve from a perspective that is very different from their own - they are a villager or a Chinese government official during this activity. In the discussion of how to reconcile the often conflicting priorities that may be developed by the students, remind the class that there is often not one easy solution.

3. Like the previous activities, this activity is suitable as a role-playing exercise or may be organized in a debate format. The discussion of the Cao Hai Nature Reserve serves as a good example of both the opportunities for and challenges of involving local people in conservation. If the students have difficulty developing ideas about this topic on their own, ask them to read the written description of the Cao Hai Nature Reserve and to identify both positive and negative interactions between the reserve and the local population. For example:

Negative: when the reserve was created the villagers lost farm land that they depended upon, and as a consequence they resorted to land use practices that were detrimental to the conservation goals for the reserve.

Positive: the development of small, environmentally-friendly businesses by the villagers has given the local farmers another way to support their families without harming the natural resources within the reserve.

Read On!

The more you know, the more you can help! To keep learning about wildlife and the environment, find the following books at your school or public library.

Cranes

Doughty, Robin. *Return of the Whooping Crane*. University of Texas Press. 1989. This book charts the recovery story of the whooping crane from the brink of extinction.

Grooms, Steve. *The Cry of the Sandhill Crane*. Northword Press. 1991. Detailed natural history of the sandhill crane, with a short chapter on the other 14 crane species.

Johnsgard, Paul. *Crane Music: A Natural History of American Cranes*. Smithsonian. 1991. The natural history of both the sandhill crane and the whooping crane is discussed in detail.

----- *Cranes of the World*. Indiana University Press. 1983. Detailed reference book, including a comprehensive description of crane biology, range maps, history, habitats, and behavior.

Schoff, Gretchen. *Reflections: The Story of Cranes*. International Crane Foundation. 1991. All 15 species of cranes and the problems they face are described in this concise book.

Field Guides

Audubon Society Pocket Guides. *Familiar Butterflies, Familiar Insects and Spiders, and Familiar Reptiles and Amphibians*.

Benyus, Janine. *The Field Guide to Wildlife Habitats of the Eastern U.S. and Northwoods Wildlife*. Reader's Digest Association. *North American Wildlife*.

Stokes Nature Guides. *Observing Insect Lives, Nature in Winter, and Bird Behavior I and II*.

Nature/Ecology

Leopold, Aldo. *A Sand County Almanac*.

Madsen, John. *Where the Sky Began*.

Manning, A. *An Introduction to Animal Behavior*.

Maser, Chris. *Forest Primeval*.

Muir, John. *The Wilderness World of John Muir*.

Olson, Sigurd. *Listening Point*.

Watts, Mary. *Reading the Landscape*.

Magazines

Audubon
Natural History

Living Bird Quarterly
Nature Conservancy News

National Wildlife
International Wildlife

Putting Vision into Action

History of the International Crane Foundation

The International Crane Foundation (ICF) was founded in 1973 in Baraboo, Wisconsin by George Archibald and Ron Sauey. Both men were graduate students in ornithology at Cornell University when they developed their vision to begin ICF. George and Ron were very concerned about the future of crane conservation and decided to start their own organization dedicated to the protection of cranes and the wetland and grassland ecosystems on which they depend.

Having very few financial resources, Ron and George asked Ron's parents for the use of their family farm in Baraboo to begin their foundation. Mr. and Mrs. Sauey were very supportive of their project, and allowed them to rent their former horse farm for only \$1 per year. After remodeling to make the farm appropriate for cranes, the next step was to obtain birds to begin a captive breeding program. George and Ron wrote to zoos around the world, asking for cranes on loan to begin their captive flock. The goal of their new foundation was to develop a captive breeding flock that would provide a "species bank" in the event that some crane species became extinct in the wild. Luckily, several zoos responded to Ron and George's requests, and ICF was underway!

As their organization grew in terms of both cranes and staff members, ICF moved to its current location in the early 1980s. ICF's mission today focuses on 5 major program areas: education, research, captive breeding, reintroduction, and habitat restoration and preservation. Each of these efforts are implemented at both local and global levels.

Like many other successful organizations, ICF started with a vision developed by a small group of enthusiastic and determined individuals. Making a dream a reality may often seem impossible. However, ICF's success shows that we all can make a difference and affect the world in a positive manner through hard work and dedication.

Have you ever had a dream to make the world a better place - maybe to end poverty, hunger, or conflict? As individuals, we cannot solve all of the problems in the world, but through our personal and group actions we can have an impact on our own lives and the lives of those around us.

As a class, your challenge is to develop a plan to begin a conservation project or organization in your school or community. For example, you might choose to start an environmental club or a recycling program in your high school or community. Use your imagination in developing your ideas - after all, your dreams are limitless!

Use the provided outline to begin planning your organization or project. To get you started, we have provided examples of ICF's goals and plans as Ron and George may have outlined them when they were starting their foundation.

ACTION PLAN

I. Name or description of your project or organization:

International Crane Foundation

II. Mission Statement. The mission statement is the crux of what you are trying to accomplish:

The International Crane Foundation (ICF) works worldwide to conserve cranes and the wetland, grassland and other ecosystems on which they depend. ICF is dedicated to providing experience, knowledge, and inspiration to involve people in resolving threats to these ecosystems.

III. Goals. This is the general plan or purpose of what you want to accomplish. Your goals are an expansion of your mission statement.

Two goals is the bare minimum:

1. Develop a captive crane population to serve as a species bank for crane populations in the wild.
2. Work to protect and restore wetland and grassland ecosystems worldwide.

IV. Objectives. The objectives measure the success of your goals. For each goal you should have at least one objective:

1. Successfully breed each of the 15 crane species in captivity.
2. Begin an on-site restoration project to learn how to restore wetland and grassland ecosystems.

V. The Plan. Specific details of all that you are going to do:

Select site to begin foundation and raise funding to prepare facilities for breeding cranes. Contact organizations with captive cranes and request birds on loan to begin captive flock. Recruit volunteers and staff members to assist with breeding and restoration programs. Begin experiment with prairie and grassland ecosystem restoration on site.

What is your Ecological Footprint?

Historically, many people have viewed nature as a collection of resources to be consumed without limits. Unfortunately, to ensure a healthy environment, it is critical that our use of natural resources does not exceed their rate of renewal, and that waste is not created faster than it can be processed. Recent signs, such as the increased extinction of species, accumulation of greenhouse gases in the atmosphere, widespread deforestation and soil erosion, and fishery depletion suggest that our current use of natural resources is exceeding the limit for sustaining a healthy environment.

It is easy to think that, as an individual, your actions do not contribute that much to the environmental problems that are becoming more evident throughout the world. After all, you are only one person, and how many resources can you consume in your life? Unfortunately, the answer to this question is more than you might imagine. To help put our resource use into perspective, the Earthday Network and Redfining Progress's website showcases a way to measure our natural resource use using land area as a unit of measurement:

An **ecological footprint** is defined as the amount of land required from nature to support each individual's present resource consumption.

According to this formula, the average American's ecological footprint is approximately ten hectares (twenty five acres)! How do you compare? To calculate your own ecological footprint, visit the following website and fill out a simple questionnaire. It only takes a few minutes, and the results may surprise you!

CALCULATE YOUR ECOLOGICAL FOOTPRINT!

www.myfootprint.org

WHAT CAN I DO TO HELP REDUCE MY ECOLOGICAL FOOTPRINT?

- ✓ Compost food and yard waste
- ✓ Use more energy-efficient light bulbs, shower heads, etc.
- ✓ Plant a garden
- ✓ Use public transportation, bike, or walk when possible
- ✓ Buy from local businesses
- ✓ Recycle
- ✓ Patronize environmentally and socially responsible businesses and organizations



Evaluation

THANK YOU for taking the time and effort to fill out this evaluation form. This information will be used to better serve you and others in the future.

Please mail your completed evaluation to:

International Crane Foundation
Visitor Programs Coordinator
P.O. Box 447
Baraboo, WI 53913

Tour Date:

Weather Conditions:

School:

Grade(s):

**Please indicate with a check which categories were applicable to your tour.
Please indicate with a circle how useful each was, using the following scale:**

1 – Excellent/Very Helpful

2- Adequate

3–Poor/Not Helpful

Use the space provided or an extra sheet of paper for additional comments regarding any of the activities.

Preparation Activities: Activity Packet

___Teacher Instructions.	1	2	3
___Chaperone Instructions	1	2	3
___Student response to the activity packet	1	2	3
___How did the activity packet fit into your lesson plans?	1	2	3
___How useful was the curriculum packet and field trip in assisting you in satisfying the Wisconsin Model Academic Standards in your classroom?	1	2	3

How much time did you spend on preparation activities? _____

Evaluation of Activities:

___ How useful were the activities? 1 2 3
___ Was the organization of the activities useful? 1 2 3

How could our activities be improved?

Field Trip:

___ Tour format 1 2 3
___ Duration of tour 1 2 3
___ Tour content 1 2 3
___ Student response to tour 1 2 3
___ Instructor response to tour 1 2 3
___ How likely are you to come again? 1 2 3

How could the field trip be improved?

Projects:

___ How useful were the additional projects? 1 2 3

Which one(s) did you choose?

Additional comments:

ICF Site Map

