



INTERNATIONAL CRANE FOUNDATION

How to use this activity packet: Pages 1-7 are informational materials to be used by the instructor to provide background information. This section also contains an answer key. Pages 9-15 are student worksheets that can be printed and used for the classroom activity.

WHOOPING CRANE POPULATION GRAPHING ACTIVITY

Instructor's Guide/Answer Key

Grade Level: 9-11

Length of Time: 45-60 minutes

Essential Questions:

- How have human activities affected Whooping Crane populations?
- What environmental factors drive changes in crane population numbers?
- What are strategies for conserving an endangered species?

Standards:

Mathematics

- **M.F.IF.B.6.** Calculate and interpret the average rate of change of a linear or nonlinear function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Materials: Graph paper, rulers, student worksheets (pages 9-15), computer, projector

Key Vocabulary:

Wetland: A type of ecosystem where the land is covered with water for at least a portion of the year.

Population: A group of individuals of the same species living and interbreeding in the same area.

Instructions:

Background

Sandhill Cranes (*least concern*) and Whooping Cranes (*endangered*) are found across North America today, however, in the 1940's Sandhill Crane populations had drastically declined and Whooping Cranes faced near extinction. This was largely because of unregulated hunting, markets for their eggs and feathers, and widespread destruction of wetland habitats. Since the 1940's, Sandhill Cranes have recovered and are now the most abundant species of cranes, numbering over 1,000,000 individuals. Whooping Cranes on the other hand have required more intensive conservation management and are slowly rebuilding their populations and recovering their range. At their lowest, only 21 individual Whooping Cranes were left in the world. Today, there are 4 populations of Whooping Cranes and almost 700 individuals in the wild.

Cranes rely on wetlands for their food, water, shelter, and space, making wetlands their primary habitat. Some crane species, like the Whooping Crane, are heavily dependent on wetland habitats to find food, roost, and build nests. Whooping Cranes are omnivorous, which means they eat both plants and animals. Their diet consists of minnows, insects, frogs, crabs, crayfish, snails, rodents, smaller birds, and plant material, all of which can be found in wetlands. Wetlands are also home to foxes, coyotes, bobcats, raccoons, and raptors that can predate on Whooping Crane adults and young.

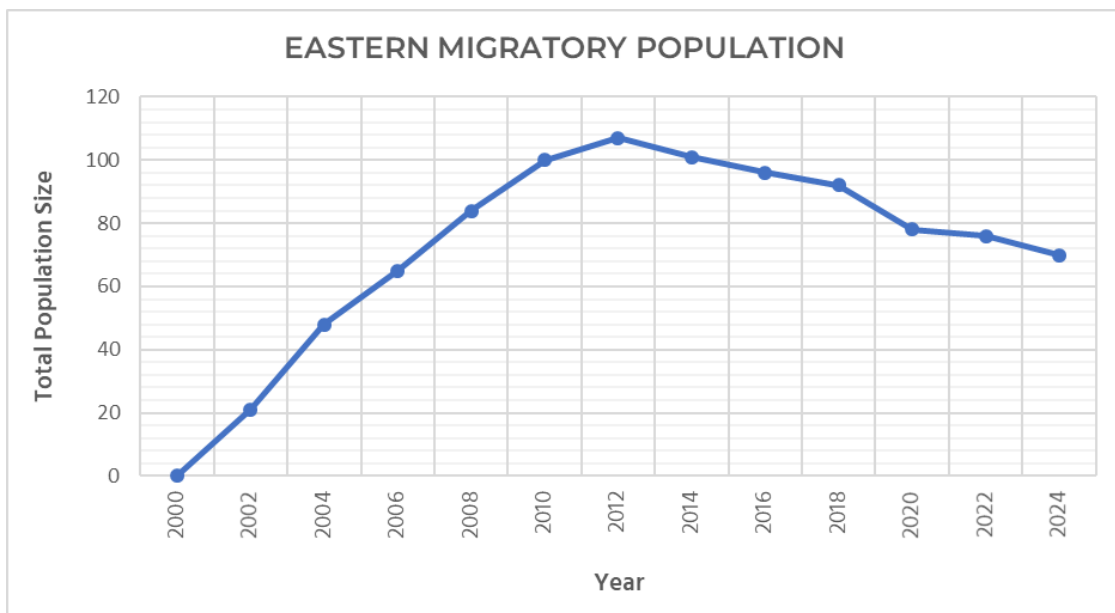
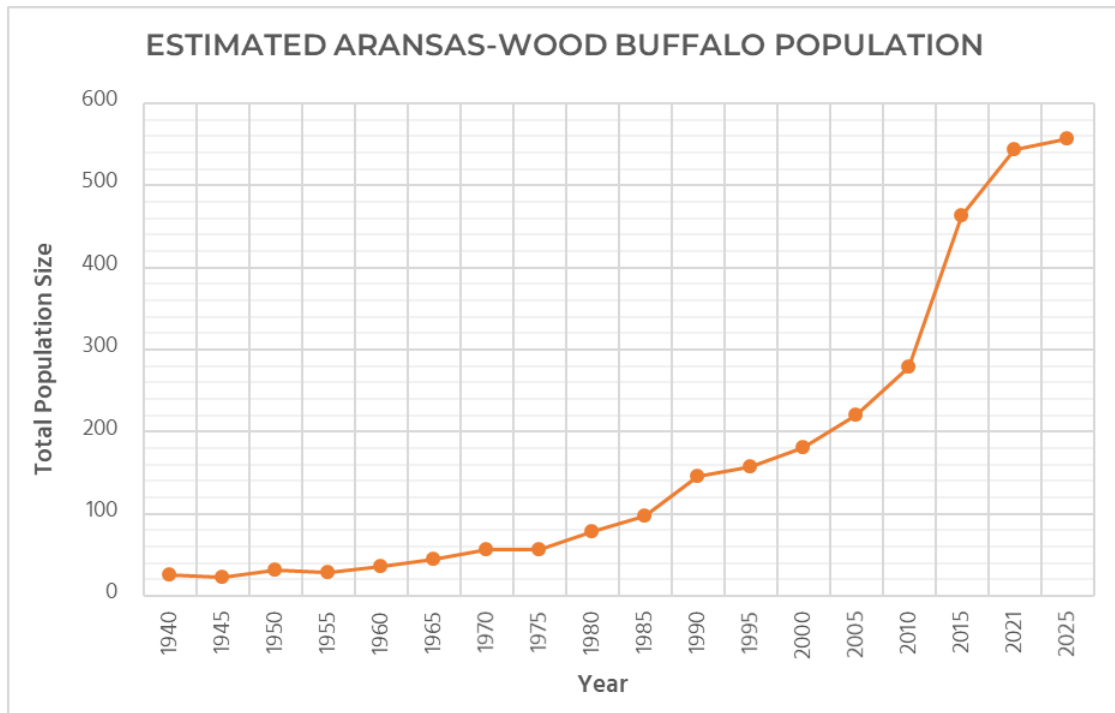
The International Crane Foundation (ICF) works to conserve Whooping Cranes by protecting their habitats and supplementing their population growth through a reintroduction program. Since 2001, ICF has pioneered techniques for breeding and raising Whooping Cranes in human care for release into the wild. This has allowed for the establishment of a second migratory population, which has increased the species' resilience. With the help of many other non-profit organizations and government agencies, this reintroduced population, known as the Eastern Migratory Population, now has about 70 individuals. As of 2025, there are about 550 Whooping Cranes in the last remaining wild population from the 1940s, known as the Aransas-Wood Buffalo Population. The Aransas-Wood Buffalo population migrates between Wood Buffalo National Park in Northern Alberta, Canada and Aransas National Wildlife Refuge on the Gulf Coast of Texas. These birds follow a narrow corridor between their summer and winter homes, stopping at key wetlands along the way. Whooping Crane numbers have increased greatly since the 1940s, but face continual threats such as loss of wetland habitat, predation, powerline collisions,

and accidental shootings. The International Crane Foundation and close partners continue to monitor Whooping Crane populations throughout the country.

Through the following activity, students will use line graphs to examine trends in these two populations over time and design conservation solutions for sustaining this endangered species.

Activity Directions

1. Pass out a student activity packet to each student. Have rulers available if needed.
2. Instruct students to read through the introduction and complete parts one and two of the student worksheet. For any questions about Whooping Crane ecology, visit <https://savingcranes.org/species/whooping-crane/>.
3. Once students have completed the entire worksheet, review answers together as a class. Project the graphs below for students to compare them to their own. The shape of their trendlines should mimic those below.



Answer Key

1. **a. What five-year interval saw the highest rate of growth in the Aransas-Wood Buffalo population? Calculate the rate of change for this line.**

- 2010-2015
- 37 birds per year (see equation below)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{463 - 278}{2015 - 2010} = \frac{185}{5} = 37 \text{ birds per year}$$

- b. Hypothesize two environmental changes that might cause this increase in crane numbers.**

- Lower predation rates than during previous intervals
- Higher food availability
- Ideal weather conditions to safely complete migrations, resulting in higher survival rates for young during this interval
- Proper water quality and water levels
- High reproductive success

2. **The Endangered Species Act of 1973 is a federal law that works to conserve threatened and endangered plants, animals, and insects by protecting their habitat and prohibiting “take” of those species. Compare the average rate of AWBP growth before and after the Endangered Species Act.**

- Before ESA: 1.03 birds per year (see equation below)
- After ESA: 10 birds per year (see equation below)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{57 - 26}{1970 - 1940} = \frac{31}{30} = 1.03 \text{ birds per year}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{557 - 57}{2025 - 1975} = \frac{500}{50} = 10 \text{ birds per year}$$

3. **a. What two-year interval saw the steepest decline in the Eastern Migratory Population? Calculate the rate of change for this line.**

- 2018-2020
- -7 birds per year (see equation below)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{78 - 92}{2020 - 2018} = \frac{-14}{2} = -7 \text{ birds per year}$$

b. Hypothesize two environmental changes that might cause this decrease in crane numbers.

- Natural disaster: flood, wildfire, tornado, drought – Severe weather conditions can affect the survival of eggs, chicks, juveniles, and adults
- Higher predation rates: eggs, chicks, and juveniles can be predated on by a variety of wildlife
- Lower food availability
- Water pollution
- New powerline construction through flyways. Powerline collision related injury or death is one of the leading causes of mortality for cranes (after predation)

4. Cranes, like all living beings, need food, water, shelter (nests) and space to survive. For each of these needs, brainstorm one human intervention that could protect or improve resource availability for cranes. For example: we can protect water for cranes by limiting the use of herbicides and pesticides that may run off into wetlands.

Food: prohibit fishing in key wetlands, plant natives that insects depend on, keep litter out of wetlands

Water: limit use of agricultural chemicals, keep litter out of wetlands, do not drain or dam wetlands for agriculture

Shelter: keep distance from nests, restore native prairie, keep litter out of wetlands, do not drain wetlands for agriculture

Space: designate and protect nature and wildlife areas, avoid human development near wetlands, lobby for protections like the Endangered Species Act

Wrap-up

Students now understand what a population is, what can affect population dynamics, and how humans can intervene to support vulnerable population dynamics. Although Whooping Cranes have made a significant recovery since the 1940s, they still face ever-evolving threats from climate change and habitat loss to human development in wetlands. By learning about different species' habitat needs, advocating for habitat protection, and supporting the International Crane Foundation, students can secure positive population trends for Whoopers well into the future.



Additional Resources

Nature Education: Introduction to Population Dynamics

<https://www.nature.com/scitable/knowledge/library/introduction-to-population-demographics-83032908/>

United States Environmental Protection Agency: Summary of the Endangered Species Act

<https://www.epa.gov/laws-regulations/summary-endangered-species-act>



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WHOOPING CRANE POPULATION GRAPHING

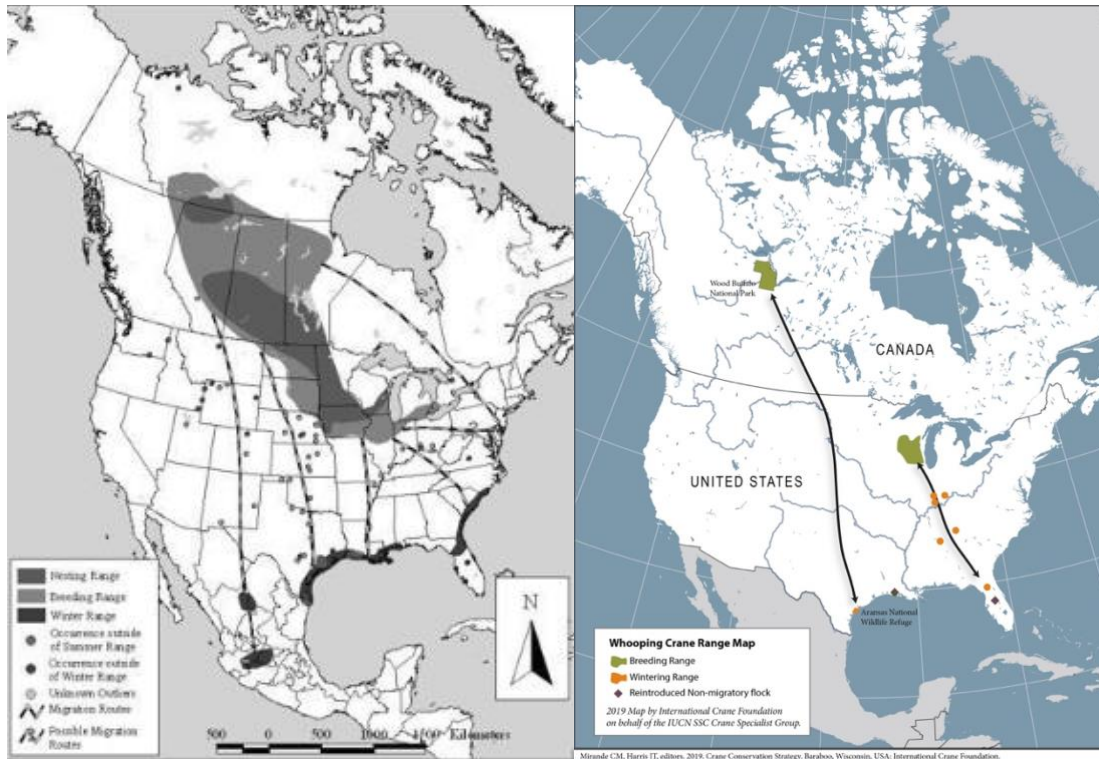
Have you ever seen a crane? There are two species found in North America: the Sandhill Crane and the Whooping Crane. The Sandhill Crane is the most abundant crane in the world, whereas the Whooping Crane is the rarest of all 15 species. Cranes find their habitat in **wetlands**, which can be defined as places with standing water for at least part of the year. Wetlands provide food and water in addition to safe places for cranes to raise their young, stopover on migration, and spend the winter. Both Whooping and Sandhill Cranes have faced severe threats to their survival from overhunting and habitat loss to rising sea levels and draining of wetlands for development. Since 1973, the International Crane Foundation (ICF) has worked to conserve cranes and the ecosystems, watersheds, and flyways on which they depend. For ICF's North America team, Whooping Cranes are of great concern.



Whooping Cranes were once abundant and widespread across North America. But in the 1940s, due to unregulated hunting and the conversion of wetlands to farmlands, they dwindled to just one population of 18 individuals left in the world. A **population** is a group of individuals of the same species living and breeding in the same area. This small population of Whooping Cranes was at great risk of extinction for two main reasons. Firstly, small populations (or populations with a low number of individuals) are at greater risk of extinction since there are fewer numbers of suitable mates, and a higher potential for inbreeding, which often has genetic consequences. The second reason is that for long term survival, it is essential for a species to have multiple populations in different locations. A small number of populations or narrow geographic range can make an entire species vulnerable to threats such as wildfires, floods, pollution events, and habitat loss. One catastrophic event could lead to extinction for an entire species if they are only found in one area.

Since 2001, the International Crane Foundation has raised Whooping Cranes in human care and released them into the wild to maximize genetic diversity and establish a secondary wild population. ICF, in collaboration with many partner organizations and government agencies, established the Eastern Migratory Population (EMP) that breeds in Wisconsin and winters in variable locations from southern Indiana to northern Florida. The remnant wild flock, descending from the surviving 18 individuals from the 1940s, is known as the Aransas-Wood Buffalo Population (AWBP). These Whooping Cranes breed in Wood Buffalo National Park in Alberta, Canada and

migrate to Port Aransas, Texas for the winter. In the following activity, you will use line graphs to examine trends in these two populations over time and design conservation solutions for sustaining this endangered species.



Historic vs. current range of Whooping Crane populations across North America.

Part One: Aransas-Wood Buffalo Population

Using the graphing paper at the end of the activity packet and the data in the table below, create a line graph of the number of cranes in the Aransas-Wood Buffalo population over time. The data has been condensed into 5-year intervals for ease of graphing. Make sure to include a chart title, x- and y-axis labels, and a trendline. Once you have completed your graph, use the information to answer the questions on the next page.

Year	Estimated Aransas-Wood Buffalo Population
1940	26
1945	22
1950	31
1955	28
1960	36
1965	44
1970	57
1975	57
1980	78
1985	97
1990	146
1995	158
2000	180
2005	220
2010	278
2015	463
2021	543
2025	557

1. a. What five-year interval saw the highest rate of growth in the Aransas-Wood Buffalo population? Calculate the rate of change for this line.

b. Hypothesize two environmental changes that might cause this increase in crane numbers.

2. The Endangered Species Act of 1973 is a federal law that works to conserve threatened and endangered plants, animals, and insects by protecting their habitat and prohibiting “take” of those species. Compare the average rate of AWBP growth before and after the Endangered Species Act.

Part Two: Eastern Migratory Population

Using the graphing paper at the end of the activity packet and the data in the table below, create a line graph of the number of cranes in the Eastern Migratory Population over time. The data has been condensed into 2-year intervals for ease of graphing. Make sure to include a chart title, x- and y- axis labels, and a trendline. Once you have completed your graph, use the information to answer the questions on the next page.

Year	Estimated Eastern Migratory Population
2000	0
2002	21
2004	48
2006	65
2008	84
2010	100
2012	107
2014	101
2016	96
2018	92
2020	78
2022	76
2024	70

3. a. What two-year interval saw the steepest decline in the Eastern Migratory Population?
Calculate the rate of change for this line.

b. Hypothesize two environmental changes that might cause this decrease in crane numbers.

4. Cranes, like all living beings, need food, water, shelter (nests) and space to survive. For each of these needs, brainstorm one human intervention that could protect or improve resource availability for cranes. For example: we can protect water for cranes by limiting the use of herbicides and pesticides that may run off into wetlands.

Food:

Water:

Shelter:

Space:

