| Activity Type | Statistics and probability |
| :--- | :--- |
| Focus Areas | Mathematics, science |
| Time Required | $30-60$ minutes |

## Overview

The recent biodiversity assessments conducted by WWF and other contributing organizations revealed a $60 \%$ decline in populations of fish, birds, mammals, amphibians, and reptile species in the past 40 years. More than one million species are now threatened with extinction and that number will only increase if we don't change course now. In this activity, students will plot species population data and use observed trends to determine the probability of their survival.

## Objective

## At the completion of the activity, students should be able to:

- Graph population data of endangered species over time.
- Analyze and interpret the population trends to predict extinction probability.
- Explain why monitoring these population trends is important to shape our actions for the future.


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## Subject and Standards

## Common Core Standards: Math

- 6.SP.B.4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- 6.SP.B.5: Summarize numerical data sets in relation to their context.
- 7.SP.A.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- 7.SP.A.2: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
- 8.SP.A.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.
- 8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
- 8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.


## Next Generation Science Standards

- MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics
- Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-ESS3-4 Earth and Human Activity
- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.


## Materials Needed

- Biodiversity Educator's Resource Guide
- Data table of species population numbers (included in this activity)
- Graph paper
- Pencil
- Internet access (optional)
- International Union for Conservation of Nature's (IUCN) Red List


## Vocabulary

- Biodiversity: all of the different kinds of life you will find in one area, including animals, plants, fungi, bacteria, habitats, ecosystems, and genetic material
- Ecosystem: the living (plants, animals, other organisms) and nonliving (air, water, soil) components of an area that interact with each other in an interconnected way
- Line of best fit: a straight "trend" line that attempts to best represent the data on a scatter plot


## Activity Procedure

## Part 1: Introduction and Preparation

- Using information from the Biodiversity Educator's Resource Guide, familiarize students with the meaning of biodiversity and why it is important.
- A key point that students should understand is that the decline of species and habitats is a direct result of the decline of nature, on which we all depend. The more species and ecosystems that exist in an area, the more contributors there are working together, making the system stronger and helping nature to thrive. If biodiversity is low, the stability of the system weakens and all that depend on it will be affected
- Discuss with your students how scientists study biodiversity. For example, every two years, scientists from WWF and other conservation organizations compile data from meticulous assessments of the world's species and habitats to evaluate the state of our planet in the Living Planet Report. When studying

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an area's biodiversity, scientists look at different criteria to help them evaluate its current status, as well as how it has changed or improved in that area:

- The number of different types of species found in that area (composition)
- The actual count of individuals of each species (abundance)
- How spread out the individuals are (distribution)
- How many of these species have been identified as being threatened or endangered (extinction risk)
- Take a few moments to review species extinction classifications with students using the International Union for Conservation of Nature's (IUCN) Red List. This comprehensive database provides information on species such as their geographic range, habitat, threats, population counts, and current extinction status. It can be difficult to keep an accurate count of many species, given their fragmented populations and/or elusive nature. But it's important for scientists to monitor numbers and draw inferences in trends to shape conservation actions necessary for species to thrive.


## Part 2: Activity

In this activity, students will plot species population data on a graph and use the observed trends to predict the likelihood of the species' survival in the future.

- Have students select a species for which to research population data. They should select a species that is currently classified as vulnerable, endangered, or critically endangered by the IUCN. If time allows, have students select a species to research online and find population counts from at least three or four different years. You can also have students choose a species from the data table included in this activity. This table consists of several species that have been identified as being at risk, as well as their surveyed population numbers from different years.

| Species | Extinction status | Population counts |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Vaquita | Critically endangered | 567 in 1997 | 245 in 2008 | 59 in 2015 | 18 in 2017 |
| Black rhino | Critically endangered | 100,000 in 1960 | 2,410 in 1995 | 4,880 in 2010 |  |
| Tiger | Endangered | 6,000 in 1998 | 3,200 in 2010 | 3,890 in 2016 |  |
| Galapagos penguin | Endangered | 2,020 in 1970 | 1,009 in 2007 | 1,200 in 2018 |  |
| Baiji river dolphin | Critically endangered | 400 in 1981 | 300 in 1985 | 100 in 1990 | 13 in 1999 |
| Snow leopard | Vulnerable | 4,080 in 2003 | 3,920 in 2013 | 2,710 in 2016 |  |
| Black-footed ferret | Endangered | 500 in 2008 | 274 in 2012 | 206 in 2015 |  |

- Once students have selected a species and gathered the required information, they should use graph paper to diagram the population counts over time. Once the points are plotted, students should establish a line of best fit (if possible) to predict the population trend. See example:

- Based on their graph, have students draw inferences from the data and make predictions for the future of their selected species. Do they feel this species is on the rise? Or are their population numbers going to continue to decline? What do they think is the likelihood of their species going extinct? If this species were to decline, what effects would it have on the rest of the species' ecosystem?


## Part 3: Discussion and Assessment

- As a class, recap the purpose of this activity and how it relates to the work conservation scientists conduct in the field. In order to ensure a future for biodiversity and nature, it's important to be aware of trends in species populations. Ask students why they think it's important for scientists to perform these biodiversity assessments. What can we learn by evaluating the numbers and distribution of different species?
- Use the information from the Biodiversity Educator's Resource Guide to share with students what WWF and other organizations are doing to restore biodiversity and bring species back from the brink of extinction. Then, using the "What kids can do" section of the guide, provide students with ways they
can take action in their own community—such as conserving resources and planting trees-to help species around the world. It will take all of us working together to make real change and reverse our planet's biodiversity loss.


## Extended Learning Options

- If enough data points are collected and a line of best fit is determined, have students calculate slope and intercept of their graph.
- Have students select two species and plot their data together on one graph. Are there patterns between the population trends of each species? Students should use what they've learned about the threats currently facing species and biodiversity to draw inferences on how these species are associated.
- Add an additional research component to the activity by having students identify the specific threats affecting the species they chose to include in their graph. If the population trend of the species appears to be increasing, what can the increase be attributed to? If decreasing, what is being done/needs to be done to stop it?
- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the Planet Earth segment and explore how to protect life on our planet.
- Start a class fundraiser to protect biodiversity using WWF's online fundraising tool, Panda Nation. Learn more at pandanation.org.


Deforestation to make room for cornfields, Brazil.

## Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- Report: Living Planet Report 2020—published every two years, the Living Planet Report assesses the state of our planet's biodiversity and ecosystem health
- Report: Living Planet Report 2020: Youth Edition—a condensed, young-reader friendly summary of the Living Planet Report 2020
- Video: Our Planet-NETFLIX documentary made in collaboration with WWF that brings you up close and personal with some of nature's most threatened species and habitats
- Web feature: IUCN Red List of Threatened Species-the International Union for Conservation of Nature's up-to-date data on species and the threats impacting them and their habitats
- Web story: What is biodiversity?-explains why biodiversity is important and what is at risk if we don't change our behaviors

For more fun classroom activities with a focus on wild species and conservation, visit wildclassroom.org


[^1]
[^0]:    An elephant in Tarangire National Park, Tanzania.

[^1]:    Photos: page 1, James Morgan/WWF-US; page 6, © Days Edge Productions/WWF-US; page 7 © WWF-US/Elisabeth Kruger

