

## Modern Extinction — Working a Turnaround

### Lesson Overview:

In this lesson, students focus on data-driven solutions to the climate change scenario. Students first research the various methods ways scientists use to compare past and modern extinctions. Students choose a particular area of scientific study and brainstorm solutions to extinction in this area. *Racing Extinction* video clips provide examples of ways in which to raise awareness about endangered species. Groups create a multimedia presentation to promote the solutions in their field and present the solutions to classmates. The emphasis is on unique, innovative solutions that will work better than others already underway.

### *Racing Extinction* Video Clips:

- **Video Clip 1: Environmental Activists**  
This clip highlights the unsung work of environmental activists and conservationists who put their lives in danger to protect endangered species.
- **Video Clip 2: Photo Ark**  
This clip profiles the Photo Ark, one man's twenty-year attempt to photograph every captive species on Earth. The goal of the Photo Ark is to raise awareness about endangered species.
- **Video Clip 3: Using Photography to Save Species**  
Documents the use of photography as a tool to generate awareness about lesser-known endangered species such as the Florida grasshopper sparrow.
- **Video Clip 4: Amplifying the Extinction Crisis**  
In this clip, filmmaker Louie Psihoyos collaborates with Obscura Digital, Elon Musk, and a racecar driver to build an environmentally friendly mobile film projector that will amplify the message of Earth's extinction crisis.
- **Video Clip 5: Projecting Change**  
This clip presents the culmination of the awe-inspiring mobile film projection project created by the *Racing Extinction* filmmakers. Images of Earth's extinction crisis illuminate the United Nations building before a crowd of captivated onlookers in New York City.
- **Video Clip 6: Converting Hunting Cultures to Tourism Cultures**  
This clip shows how environmental activist Shawn Heinrichs works with a remote Indonesian community to educate the local population on manta ray conservation and convert their manta ray hunting industry into a tourism industry.

**Lesson Duration:** Two 45-minute sessions

**Essential Questions:**

- How do scientists study extinction?
- How can awareness be raised about extinction and endangered species?
- What kinds of solutions can be implemented to change behaviors to reduce or reverse impacts on endangered species and ecosystems?

**Objectives:**

Students will:

- Describe how scientists study extinction.
- Evaluate approaches to raising awareness about extinction and endangered species.
- Devise and analyze solutions that change behaviors that reduce or reverse impacts on endangered species and ecosystems.

**Standards:**

- *Next Generation Science Standards*
  - HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
  - HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
  - HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
  - HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
  - HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
  - HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
  - HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

- **Common Core State Standards**
  - RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
  - WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
  - WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.
  - SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

## Materials Needed:

- Computer or mobile device with Internet access
- Graphics software (optional)

## Teacher Preparation:

- Watch *Racing Extinction* video clips, or the entire documentary if possible
- Review online resources provided in lesson
- Consider strategies for ELL, struggling, and accelerated students

## Background Information (for the Teacher):

Comparison of past and present extinctions suggests that the sixth mass extinction is already underway. Scientists, policy makers and conservation organizations are actively seeking solutions. However, despite the efforts of large conservation organizations, government mandates such as the Endangered Species Act, and corporate initiatives, wildlife populations continue to dwindle. Conservation has typically relied on “top-down” approaches. That is, organizations and legislators have imposed restrictions or tried to curtail activities that are seen to impact the environment. But again, this strategy appears to have done little to reverse the overall decline of species and habitats, despite a few hard-won victories. Innovative approaches are needed. The *Racing Extinction* documentary itself is one such effort—merely raising awareness of extinctions may prompt remedial action. Will it make a difference? That is unknown, but what is certain is that many individual actions can make a difference. Everyone’s actions every day can either contribute to continued extinctions or may counter the trend. In this lesson, students learn

about the methods scientists use to study extinction as a context for devising solutions to the extinction crisis. Such solutions may include unique approaches to raising awareness further or incentivizing and motivating behavior change to reduce or reverse impacts on endangered species and ecosystems.

Key learning points for this lesson:

- Scientists compare past and present extinctions to better understand human impacts on Earth's biota. The comparison shows the extent of human impacts compared with the "natural" or "background" rate of extinctions.
- Scientific comparison of past and present extinctions shows a higher rate of present extinctions compared with past extinctions, with a current rate as high as 1,000 times the background rate.
- Scientists use a variety of methods to compare past and present extinctions including:
  - Comparing the longevity of a species in the fossil record with a similar species today
  - Using the species-area relationship to predict the number of species lost as habitat area is reduced
  - Comparing extinction rates during mass extinctions with current extinction rates
  - Using lists of endangered species to estimate percentage losses of species
  - Using molecular data to calculate background extinction rates and compare to current rates
- The film *Racing Extinction* shows several ways in which scientists, media, and organizations are raising awareness about extinction and endangered species. Various approaches include:
  - Multimedia film, television and video productions
  - Photography used in print publications/websites, and projects such as [PhotoArk](#)
  - Graphical tools such as posters, infographics
  - Publicity campaigns
  - Online petitions
- Any solution that can change behaviors to reduce or reverse impacts on endangered species and ecosystems is potentially worthwhile. Such solutions might include:
  - Raising awareness about endangered species and ecosystems
  - Dietary changes to reduce consumption of environmentally costly foods
  - Education programs for families
  - Support for appropriate legislation and its enforcement
  - Incentivizing communities to protect their local biodiversity
  - Innovative conservation approaches that focus on biodiversity hotspots

## Procedure:

### ENGAGE

1. To engage students initially, ask them to write down one aspect of the environment in their area or region that they would change or improve.
2. Show students the *Racing Extinction* video clip 1: *Environmental Activists*.
3. Students choose one of the featured activists based on their interest in a particular ecosystem or species.
4. Students write a short passage in their notebooks summarizing in what way the activist has contributed to conservation.
5. Explain to students that they will learn how scientists compare present and past extinction rates and develop solutions to help conservationists and scientists to prevent species extinctions.

### EXPLORE

1. Working in small groups, students research online resources to explore methods and techniques for comparing data on past and present extinctions on Earth. Students should explore the following websites for relevant information:
  - a. *Nature*: [Methods of comparing present and past extinctions](#)
  - b. Encyclopedia of Biodiversity: [Comparing Extinction Rates: Past, Present, and Future](#)
2. Each group chooses one of three methods to research in detail:
  - a. Fossil record
  - b. Species-area relationship
  - c. Lists of endangered species
3. The group creates a concept map or infographic that explains how scientists use their chosen method to compare past and present extinctions.
4. The group chooses a particular biota. Example biotas include:
  - a. An ecosystem
    - i. Coral reefs
    - ii. Rainforests
    - iii. Estuary
  - b. A taxonomic group
    - i. Big cats

- ii. Raptors
    - iii. Cetaceans
  - c. Individual species
    - i. Northern right whale
    - ii. Grasshopper sparrow
    - iii. Manta ray
- 5. Students may find relevant information on the following websites:
  - a. U.S. Fish and Wildlife Service: [Endangered Species—Species Search](#)
  - b. IUCN: [Red List](#)
  - c. Kew Royal Botanical Gardens: [Endangered habitats](#)
- 6. The group explores information on the conservation status of their biota and adds this information to their concept map. Encourage students to show how their chosen method of comparison may be more or less useful for studying a particular at-risk biota.
- 7. Still working in groups, students watch one or more of the additional *Racing Extinction* video clips (2 to 5) to get an idea of the kinds of innovative approaches to solving the extinction crisis.
- 8. Groups brainstorm solutions to the extinction scenario covered by their chosen research field. Encourage students to devise new solutions not tried before. Students may refer to their notes from Lesson 1: *The Sixth Mass Extinction* for more ideas and inspiration.
- 9. Students watch *Racing Extinction* video clip 6 *Converting Hunting Cultures to Tourism Cultures* for an example of how to change behavior. Ensure that solutions students propose (from Step 7) consider impacts of individual behaviors and ways to change behavior. Students can visit the following websites for examples of innovative solutions:
  - a. Solutions: [Facing Extinction: Nine Steps to Save Biodiversity](#)
  - b. Earth Institute, Columbia University: [What You Can Do to Protect Biodiversity](#)
  - c. SavingSpecies: [Science](#)
  - d. BBC: [New York's Empire State highlights endangered animals](#)

## EXPLAIN

- 1. Groups create a multimedia presentation to explain the solutions in their chosen research field, such as a digital slide show, video or web page.
- 2. Students present their solutions to classmates, role-playing their presentation as a pitch to a company making environmental films.

3. In their pitch, students explain the particular importance of preventing extinction in their chosen ecosystem, group or species and why their solution is unique and innovative and will work better than others already underway.

## ELABORATE

1. Still working in small groups, each group chooses a case study of a specific conservation approach or method, such as creating parks and reserves, working with local communities, restoring degraded land or creating wildlife corridors. Encourage groups to include several example programs implemented by different conservation organizations. They can search the [Guidestar](#) website for lists of conservation organizations. If needed, suggest search terms such as:
  - a. wildlife conservation
  - b. biodiversity conservation
2. Groups research online resources to explore the efficacy of the conservation approach profiled in their case study. Ensure groups research challenges and failed programs as well as successful programs.
3. Each group creates a concept map to illustrate their case study of a specific conservation approach. The concept map should include key concepts including:
  - a. Program biogeographical information
    - i. Size and location of program area
    - ii. List of endangered species
    - iii. Flagship species if any
  - b. Program design objectives and outcome
  - c. Cost-benefit analysis
    - i. Overall costs of programs
    - ii. Expected conservation impact
  - d. Program outcome
  - e. Measures of program success
4. Still working in their groups, students create a plan for successful implementation of their conservation solution. The plan should include:
  - a. Goals and objectives
  - b. Explanation of why their solution is unique and innovative
  - c. Analysis of the solution's feasibility, scope and chances for success
  - d. Budget
  - e. Schedule

## EVALUATE

1. Working individually students complete the following constructed responses:
  - a. Write a short passage explaining how and why scientists compare current and present extinction rates, summarizing the scientific consensus.
  - b. Describe the importance of the fossil record, species-area relationship and endangered species lists to scientific understanding of current extinction rates.
  - c. Write a short essay describing how you would promote awareness about elevated extinction rates.
  - d. Describe three ways in which you would suggest to friends or family members behavioral changes that would help reduce extinctions.
2. Students present their group solutions to the class with the goal of persuading classmates that they should work together as a class to implement their solution.

## FOLLOW-UP

As part of Evaluate, provide students with built-in checkpoints with specific dates to meet and discuss their progress, provide assistance and create reports. Establish checkpoints at 60 days and 90 days. At each checkpoint, ask students to write in their reports answers to the questions:

Is your group in the process of implementing proposed solution?

- How well is your implementation following the original plan?
- Have you made significant changes to your original plan? If so, explain why.
- What are your criteria for success?
- What are the next steps for your team?