ROOTS OF RESILIENCE: RESTORING KENYA'S MANGROVES – LESSON PLAN

Please visit www.conservationnation.org/lessons for complete lesson materials including the lesson video, worksheets, and vocabulary list.

GRADES

5-8 (can be adapted to lower grades)

TIME REQUIRED

40 minutes for pre-lesson prep
45 minutes for live virtual lesson

SUMMARY

In this live Conservation Nation lesson, students explore how mangrove ecosystems support biodiversity, protect coastlines, and mitigate climate change through the real-world conservation work of Fredrick Kioko Kilonzo in Kenya. Using authentic scientific data on mangrove survival rates, biodiversity recovery, and carbon sequestration, students investigate how ecosystem changes affect populations and how community-led, science-based restoration strategies can reverse environmental damage.

The lesson emphasizes data analysis, ecosystem interactions, engineering design, and evidence-based reasoning, helping students understand how conservation science and community leadership work together to create sustainable solutions for both people and wildlife.

OBJECTIVES

Students will be able to...

- Analyze survival-rate and biodiversity data from restored mangrove ecosystems
- Explain how mangroves cycle matter and energy, including carbon storage
- Construct evidence-based arguments showing how ecosystem changes affect populations
- Evaluate and compare mangrove restoration strategies using scientific criteria
- Describe how community-led conservation benefits ecosystems and human livelihoods

MATERIALS

Available at www.conservationnation.org/lessons

- Pre-read article: Mangroves: "Superhero" Ecosystems (available at the link or to print in the lesson materials)
- Fredrick's Introduction video for the Pre Lesson
- Pre-lesson and lesson Slides
- Student Worksheet (data tables, graphs, reflection prompts)
- Vocabulary List

NEXT GENERATION SCIENCE STANDARDS

- **MS-LS2-1**
  Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2**
  Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-3**
  Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- **MS-LS2-4**
  Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- **MS-ETS1-2**
  Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ESS3-3**
  Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

LIVE LESSON PRE LESSON -- MANGROVE REVIVAL (30 minutes)

1. Welcome & Lesson Framing (5 minutes)

Teacher Action:

- Introduce students to **Fredrick Kilonzo**, a conservationist working in coastal Kenya to restore mangrove forests while supporting women-led, community-based conservation.
- Explain that Fredrick will join students **live via Zoom** to share **real data** from his fieldwork.

Framing Question (displayed or read aloud):

- *"What do you think happens to animals, people, and the climate when an ecosystem like a mangrove forest disappears?"*

2. Background on Mangroves (20 minutes)

Teacher Action:

- **Ask:**
  - "Has anyone heard of mangroves before?"
  - "Why might they be important?"
- **Read (10 minutes):**
  - The pre-read article titled Mangroves: "Superhero" Ecosystems
- **Video:**
  Play mangrove introduction video, stopping at **1:10**
  https://youtu.be/z2kBFJqb6x0
  - **Question Prompt (also on PowerPoint):**
  - "What questions would you ask someone who works with mangroves every day?"
  - Class to discuss questions and document those they'd like to ask Frederick.

3. Vocabulary-in-Context & Visual Preview (5 minutes)

- **Purpose:**
  Prepare students to access complex ecological and data-driven ideas.

- **Teacher Action:**
    - Project slides with **key vocabulary** alongside visuals of:
        - Healthy mangrove forests
        - Degraded mangrove areas
        - Restoration planting sites

Key Vocabulary:

- Arial roots
- Mangrove
- Ecosystem
- Ecosystem services
- Biodiversity
- Biomass
- Guaraní
- Habitat
- Nitrogen Fixation
- Population
- Productivity
- Resource Availability
- Carbon sequestration
- Restoration
- Data
- Detritus
- Monitoring
- Survival rate
- Salt Glandules
- Saprotrophs
- Sustainability
- Community-led conservation

Student Instruction:

- “Write down any words you are unsure about or curious to learn more about.”

Class Discussion (quick):

- Which words are familiar?
- Which words seem most important for the lesson?

4. Data Curiosity Warm-Up: "Which Strategy Works Better?" (7–10 minutes)

Purpose: Introduce students to real scientific data and prepare them for evidence-based reasoning.

Teacher Setup:

- Display the simplified graph in the slides
    - Mangrove survival rates using traditional planting (~60%)
    - Survival rates using integrated fish-pond restoration (85–90%)

Student Prompts:

- What differences do you notice between the two approaches?
- Which restoration method appears more successful?
- What evidence supports your thinking?
- What questions would you ask the scientist who collected this data?

Teacher Emphasis:

- Scientists use data to compare solutions—not guesses or opinions.
- Students will explore *why* these differences exist during the live lesson.

End of Pre-Lesson Prep

LIVE LESSON CLASS -- MANGROVE REVIVAL (45 minutes)

Live Lesson - Mangrove Revival

1. Welcome & Lesson Framing (3 minutes)

- Conservation Nation moderator introduces its work and role in supporting conservationists around the world. Moderator then introduces **Fredrick Kioko Kilonzo** as a conservationist working in Kenya on mangrove restoration.

Teacher Reinforcement:

- Frame the lesson as a real-world case study using science to solve environmental problems.

2. Meet the Ecosystem: Why Mangroves Matter (8 minutes)

Fredrick Leads Using Slides:

- What mangroves are and where they grow
- How mangroves support:
    - Fish nurseries
    - Bird and crab populations
    - Coastal protection from storms
    - Carbon storage in roots and sediment

Student Prompt:

Why do you think mangroves are often called "the guardians of the coast"?

Students share ideas orally.

3. What Caused Mangrove Loss? (8 minutes)

Fredrick Explains with Visuals:

- Deforestation for fuel and development
- Coastal population growth
- Changes in water flow and quality

Teacher Facilitation:

- Pause after each factor.
- Ask students to connect:
    - Human action → ecosystem change → population impact

Key Idea Emphasized:

- Environmental problems often result from *multiple interacting causes*.

4. Field Science & Survival-Rate Data (10 minutes)

Fredrick Walks Students Through:

- How mangrove survival is monitored over time
- How survival rates were calculated
- Beekeeping enterprise
- Comparison of restoration strategies:
    - Traditional planting
    - Integrated fish pond systems

Student Prompt:

"How does linking income to conservation change community attitudes toward nature?"

Students reference numbers, percentages, or trends.

5. Biodiversity Recovery: Who Comes Back? (8 minutes)

Slides Show Data On:

- Seedling survival rate with different planting approaches

Student Prompt:

"Why is community ownership important for long-term restoration success?"

6. Carbon Sequestration & Climate Impact (6 minutes)

Fredrick Explains:

- How mangroves absorb CO_2
- Where carbon is stored (biomass + sediment)
- Long-term climate benefits of restoration
- Increased bird species counts
- Higher crab density
- Improved fish presence in restored areas

Modeling Activity (Verbal or Visual):

Students trace the flow of carbon:

atmosphere → mangrove trees → soil/sediment

Student Prompt:
"Which of these impacts do you think benefits local communities the most, and why?"
Teacher highlights **ecosystem interactions**.

7. Community-Led Solutions (7 minutes)
Fredrick Shares:

- Women-led nurseries
- Beekeeping enterprises
- Community monitoring and stewardship

Think–Pair–Share:
"Why might conservation efforts last longer when local communities lead them?"
Teacher connects to sustainability and equity.

Q & A prior to Kahoot

8. REFLECTION – Kahoot! (10 minutes)
Kahoot quiz includes questions on:

- Data interpretation
- Ecosystem cause-and-effect
- Restoration strategies
- Community-led conservation

Teacher pauses briefly after select questions to clarify misconceptions.

9. CLOSE (1 minute)

Conservation Nation moderator thanks Fredrick and closes the session.