

LESSON:

Design and Evaluate an Underwater Logger

Summary: Students identify a problem with the logging industry and design a technology for underwater logging.

EHP Article Title(s): "Underwater Logging: Submarine Rediscovered Lost Wood,"
EHP Student Edition, February 2005: A892–A895.
<http://ehp.niehs.nih.gov/members/2004/112-15/innovations.html>

Objectives: By the end of this lesson, student should be able to:

1. Discuss the benefits and environmental costs of underwater logging.
2. Design an underwater logger to meet student-created criteria.
3. Evaluate their proposed design for an underwater logger.

Estimated Class Time: 90 minutes

Grade Level: 9–12

Subjects Addressed: Technology Education, Environmental Science, Physical Science

►Prepping the Lesson (15–20 minutes)

INSTRUCTIONS:

1. Obtain a class set of *EHP Student Edition*, February 2005, or download article at <http://www.ehponline.org/science-ed> and make copies.
2. Review the article, "Underwater Logging: Submarine Rediscovered Lost Wood."
3. Make copies of the student instructions (Part 1 and Part 2) and the background reading on underwater logging (provided with the student instructions).

MATERIALS (per student):

1. 1 copy of the student instructions
2. 1 copy of the background reading on underwater logging
3. 1 copy of *EHP Student Edition*, February 2005, or 1 copy of the article "Underwater Logging: Submarine Rediscovered Lost Wood"
4. 1–2 pieces of blank paper/poster paper (optional)

VOCABULARY:

Deforestation
Rediscovered wood
Sustainability
Underwater logging

BACKGROUND INFORMATION:

A "Background Reading" is included in the Student Instructions." Additional resources are provided below.



RESOURCES:

Environmental Health Perspectives, Environews by Topic, <http://ehp.niehs.nih.gov/topic>. Choose Innovative Technologies, Natural Resources, Sustainable Development/Conservation

Rainforest Alliance, SmartWood homepage, <http://www.rainforest-alliance.org/programs/forestry/smartwood/index.html>

Forest Certification Watch, This Week's Story webpage, Focus on Recovered Wood: Recovered Wood & Certification, http://certificationwatch.org/article.php3?id_article=2289&var_recherche=underwater

Book of Joe. Underwater logging in Brazil, http://www.bookofjoe.com/2004/09/underwater_logg.html

Dive Web, Commercial Diving Channel, UnderWater Magazine, "Underwater Logging; Submerged Logs Yield Premium Harvests in a Virgin Market" By Madalyn Russell, <http://www.diveweb.com/commdiver/features/uw-fa97.03.htm>

Heritage Perspectives by Doug Mackey. Underwater Logging: A New Angle on Lumber, http://www.pastforward.ca/perspectives/Oct_122001.htm

▶Implementing the Lesson

INSTRUCTIONS:

1. Hand out the student instructions including the "Background Reading" on underwater logging.
2. Review Part 1 of the instructions with the students, calling their attention to the type of information from the background reading to which they should pay particular attention.
3. Have the students read the background reading and complete the student instructions, Part 1.
4. You may want to provide some time in class for the students to begin formulating ideas for developing criteria and design solutions. You may consider having students work in groups.
5. After students have completed the student instructions, Part 1 and designed their underwater logger, review the student instructions, Part 2 and hand out copies of *EHP Student Edition*, February 2005. Refer your students to the article, "Underwater Logging: Submarine Rediscovered Lost Wood" (p. A892–A895) or hand out article copies.
6. Have students read the entire article and complete the student instructions, Part 2.

NOTES & HELPFUL HINTS:

- As an extension activity, have students build a model of their design for an underwater logger. This activity could complement a lesson on fluid dynamics.

▶Aligning with Standards

SKILLS USED OR DEVELOPED:

Communication, comprehension, critical thinking, technological design

SPECIFIC CONTENT ADDRESSED:

Technological design

NATIONAL SCIENCE EDUCATION CONTENT STANDARDS MET:

Science and Technology

- Abilities of technological design
- Understanding about science and technology

Science in Personal and Social Perspectives

- Personal and community health
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

▶Assessing the Lesson

Written responses on student instructions, Part 1 and Part 2. Criteria: accuracy and detail of observations, quality of explanations, and ability of design solutions to meet student-created criteria.

Verbal responses during classroom discussion. Criteria: Relevance and accuracy of responses.



Possible student answers for select questions:

1. Problems or needs in the logging industry:

- Demand for wood may outweigh the supply.
- Deforestation can affect soil erosion and water quality.
- Road building into pristine forests allows influx of invasive species, increases erosion, and invites off-road vehicles and human intrusion.

2. Ways underwater logging can have a negative impact on the environment:

- Silt and dirt can be stirred up in the water, which can “choke” fish and negatively affect the underwater ecosystem.
- Hydraulic fluids or gasoline can leak into the water.
- Shoreline erosion can occur when logs are removed.
- There may be effects on the waterway (e.g. movement of water).

3. Criteria to consider when designing an underwater logger and possible design solutions:

- Minimize silt and dirt disturbance with possible design solutions: machine has good buoyancy control and does not touch the bottom; machine cuts the log instead of uproots it; other creative solutions possible.
- Minimize or avoid contamination of water from fuel or hydraulic fluids with possible design solutions: use nontoxic alternatives; other creative solutions possible.
- Other criteria to consider are size, cutting mechanism, mass, corrosivity of material, length of time logger can work underwater/fuel consumption.

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STUDENT INSTRUCTIONS: Design and Evaluate an Underwater Logger

PART 1

Purpose:

To identify a problem or need in the logging industry and to design a piece of technology—an underwater logger—to address the problem or need.

Step 1: Read the background reading on underwater logging.

BACKGROUND READING ON UNDERWATER LOGGING

"The global market for industrial wood products (including wood and paper) is a \$400 billion industry, according to *From Forests to Floorboards: Trends in Industrial Roundwood Production and Consumption*, a 2001 report from the World Resources Institute. As the world's thirst for wood grows and the resulting deforestation contributes to a wide range of environmental problems, one enterprising group has gone to a surprising location to search for more sustainable wood supplies—under the water. A great amount of timber sank during log drives or was flooded during the construction of hydroelectric dams around the world. Although under water, the trees may be as good as new. One obvious—but dangerous and expensive—way to retrieve this "rediscovered wood" is to hire divers to run underwater saws. A second solution, uprooting the trees with a chain, mucks up the water and disrupts aquatic ecosystems.

Underwater Logging: Tough, but Not Impossible

Underwater logging is possible because many submerged trees and logs are barely affected by their decades of submersion. Lake and river water is often too cold and too deficient in oxygen for decay organisms to survive. (Ironically, the abovewater portion of trees often must be discarded due to degradation by sunlight and microorganisms.) It's hard to pinpoint how many trees are available for underwater logging. Some underwater logs were sunk or otherwise lost during log drives on rivers, but the majority came from forests submerged during the building of dams. Triton Logging president Chris Godsall estimates that about 35,000 square kilometers of forest worldwide have already been submerged by dams. In British Columbia alone, he says, about 20 million trees lay underwater.

The Environmental Payoff

Drowned logs, sunken trees, and wood from building demolition are all considered rediscovered wood. The environmental promise of using rediscovered wood is to reduce the impact of logging and the attendant road building on forests. But the environmental benefits of recovering drowned trees are difficult to compare to the standard of being "sustainable" because the trees are not replaced, even though other trees are being drowned by newer dams. Underwater logging can pose an environmental hazard if silt on the drowned logs is distributed into the water. Unlike sawing, the past practice of yanking standing trees from lake beds can pollute the water with sediment, blocking the light needed by aquatic plants. Other hazards include logs that are recovered but not reclaimed, which then drift downriver, disturbing aquatic life that have created a habitat out of the drowned logs or sunken trees, or possible underwater noise pollution.

Some in the forest products industry question the need for underwater logging, noting that forests have been expanding for about a century in the United States. Eugene Wengert, a forest products industry consultant and retired professor of forest ecology and management from the University of Wisconsin–Madison, argues that conventional logging itself may actually be sustainable. Perhaps, but Godsall argues that sustainable forestry is still a goal, not a reality, in the industry. "With underwater logging, every acre of drowned trees that is chain sawed in a hydroelectric reservoir should translate into an acre of forest that's left standing. And that, in turn, could translate into significant environmental benefits for the world."

Excerpts from the article "Underwater Logging: Submarine Rediscovered Lost Wood," *EHP Student Edition*, February 2005: A892–A895.

Step 2: State a problem or need in the logging industry based on the reading.

Step 3: The logging industry has identified underwater logging as one method to reduce the impact of logging on the environment. However, underwater logging can also negatively impact the environment. List at least three ways underwater logging can have a negative impact on the environment. (Use the background reading and your own ideas to identify negative impacts.)



Step 4: Taking these negative impacts into consideration as criteria and any other ideas, develop at least five criteria that should be considered when designing an underwater logger. Then, develop design solutions that addresses your criteria. (You may also want to consider how the underwater logger is operated and what types of fluids or chemicals are used, e.g., for the hydraulic system.)

CRITERIA	DESIGN SOLUTION

PART 2

Purpose:
To evaluate your proposed underwater logger to determine whether it would be eligible for certification for quality logging practices.

Step 1: Read the entire article "Underwater Logging: Submarine Rediscovered Lost Wood," from *EHP Student Edition*, February 2005: A892–A895.

Step 2: Based on the entire article, review and revise your proposed design solutions for your underwater logger. Add any additional criteria and design solutions below.

CRITERIA	DESIGN SOLUTION

Step 3: Much of the logging industry is seeking certification that their logging practices meet high environmental and social standards. Major retailers prefer to purchase products made from certified wood and companies that support environmental causes have a better public image. Explain why your design should be certified.

