



Science

MYSTERY OF TAIGA RIVER

Overview

This game narrative is designed to help players understand the complexities in decision-making that exist in all communities, as they investigate and propose solutions to resolve a fish decline in a small national park. As a part of this experience, students take on the role of a scientific field investigator by interviewing stakeholders, conducting experiments on how water quality affects fish life, and collecting data.

They will explore the scientific method to develop hypotheses about the park's problem and pose possible solutions. Through these efforts they will come to understand the idea of a system and how complex problems that involve a wide range of agendas and viewpoints require complex solutions.

Learning Objectives

Students will:

- Develop understanding of the factors of water quality, including dissolved oxygen, pH, turbidity, and nutrient levels.
- Understand the fragile nature of our various ecological systems and that these systems are interconnected, recognizing that one change impacts the entire system.
- Appreciate that decisions about use of natural resources must balance the needs of many stakeholders, and that one solution may create problems in other areas.
- Explore the socio-political factors that underlie scientific inquiry.

Content Questions

- What factors affect the health of an aquatic ecosystem?
- How do living things change when their environment changes?
- How do my decisions and/or actions affect the environment?

Big Ideas

- Inquiry involves identifying the problem, gathering data, generating hypotheses, recognizing the perspectives and needs of various stakeholders, analyzing data, proposing solutions, and reflecting and revising on each of these.
- Systems thinking helps us to solve complex problems by recognizing how parts of a system interrelate and combine with others.
- A true understanding of science includes an awareness of the inter-connectedness of all life and a responsibility to the environment.

9–15 computer lab days with additional time in classroom.



Table of Contents

This comprehensive unit guide for **Mystery of Taiga River (Taiga)** unit has been organized for the busy classroom teacher's convenience. Each mission of the guide comes with its own 4-page support document, including a single-page pullout sheet you can carry around with you while students work on computers. In addition, each has at least one classroom activity, located in Appendix A at the back of this guide, to help you support specific concepts and skills taught in this persuasive writing unit. Use the guide below to quickly locate what you need.

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Things to know before you begin...

Our Learning Philosophy

Much has been written about the educational potential of games, but as teachers know, merely playing a game does not ensure that one is truly learning. That is why we developed the theory of **transformational play**.

Atlantis Remixed (ARX) games offer something new to learners: unlike any other form of curriculum, these games offer entire worlds in which learners are central, important participants. Students who play **transformationally** become protagonists who use the knowledge, skills, and concepts of specific **educational content** to first make sense of a situation and then make choices that actually transform the play space and the player—students are able to SEE how that space changed because of their own efforts.

Rather than just placing work and play side-by-side, the ARX Project strives to make learning fun and to show kids **they can make a difference in the world**.

But none of this can happen without the full support and engaged cooperation of YOU, the classroom teacher. ARX is not a teacher, it is a curriculum, a tool like any other classroom resource. In order for it to be effective, you must help students to discuss their findings, to make sense of the content, and to understand the consequences of each action they take.

We hope that this guide and its accompanying materials will help you in creating learning opportunities that transform your own and your students' understanding of the potential of Atlantis Remixed and transformational play. Enjoy!

"Video games offer students a place where what one knows is directly related to what one is able to do, and ultimately, who one becomes."

Dr. Sasha Barab



Key Terms and Icons

Look for these icons scattered throughout the lessons for specific information and types of activities suggested to support this unit.



Resources or
Background
Information



Classroom
Activity



Discussion
Prompts



Teachable
Moment



Common
Misconception



Tailored
Instruction



Tips or
Important
Information



Something
to Look For

The World of the Remixers...

Welcome, recruits, to the Remixer Hub! From this high-tech space, you will join others in travelling to distant worlds, solving problems of global importance and fighting injustice wherever they find it. If you want to become a full-fledged Remixer yourself, you must commit yourself to the same ideals.



Remixers know that their actions in these worlds make a difference. Whether they are writing a persuasive essay to help a village ravaged by a plague, analyzing water quality in a river to save a national park, or investigating the mysteries of an ancient people to understand the importance of personal histories, Remixers become active agents whose decisions have consequences and make a difference in the worlds they visit.

But Remixers are not sent into these situations without backup. An intrepid band of teens and young adults have dedicated themselves and their technology to ensuring that Remixers in the field have the best support possible. Whenever a new tool is needed or a new problem is discovered, this Remixer council springs into action to help make sure you have the information you need to solve all of the worlds' problems!

The Remixer Council

Uki	Leads the Remixers
Gatekeeper Adam	Monitors teleports and supports field operatives
TekAnn	Invents all Remix gadgets
Evelyn	Monitors worlds, looking for problems
Belle	Controls avatar functionality
Collector Matt	Services backpacks and reviews items collected in the field

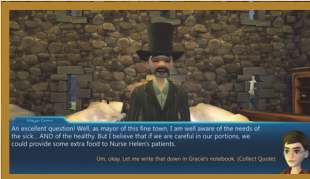
Video Game Vocabulary

Games, like any other specialty, come with some unique terms and phrases that your students will quickly pick up as they play. Following is a short list of words to help you keep up!



AVATAR

Your in-game persona. The character that represents YOU in a video game.



NPCs

The "Non-Player Characters" that players engage within a video game narrative. These characters move the story along.



FIRST OR THIRD PERSON

How you view the game, either through the eyes of your avatar or from a fixed distance behind.



LEVELING UP

As students gain more experience in the game, they are given more tools and rewards.



EASTER EGGS

Intentional hidden messages, objects, or jokes lying around the 3D landscape of a video game.



Mystery at Taiga River asks students to take on the task of saving a national park in which the population of a unique fish has been declining. They will use an understanding of scientific inquiry as well as systems thinking to tackle this problem, which is compounded by the agendas of several groups of people who use and/or depend upon the river in some capacity.

In an attempt to find solutions to the problem, Ranger Bartle has requested that a water quality expert be sent to look into the problem. Players are tasked by the Remixers to take on this role, and soon find themselves gathering data, performing virtual experiments to analyze the quality of the water in various sites, and, ultimately, proposing solutions to the problem.

This unit is designed to teach students a systems-thinking approach to problem solving, the importance of careful scientific inquiry, and how to balance human needs with the needs of an ecosystem at risk.

Disciplinary Focus

Life & Earth Sciences

- Interdependent relationships in ecosystems
- Human impacts on earth systems

Language Arts

- Reading in science & technology
- Crafting arguments based on discipline-specific content



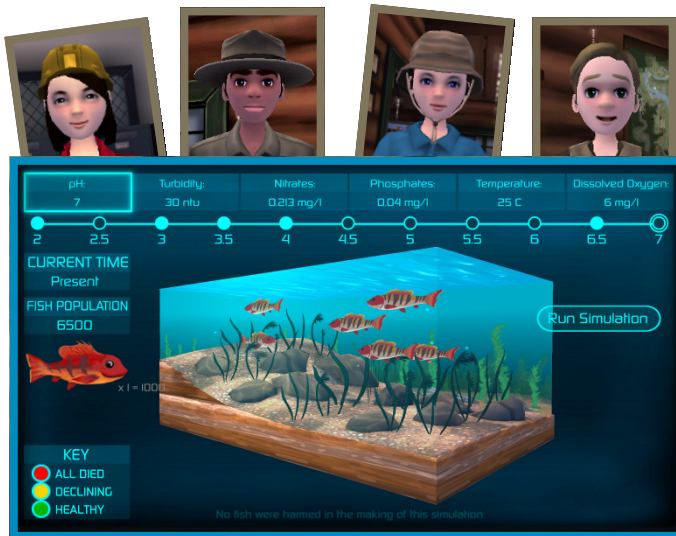
Time Management

- 7–10 Computer sessions
- 5–8 Classroom support activities

Grades 6–8

Big Ideas

- Inquiry involves identifying the problem, gathering data, generating hypotheses, recognizing perspectives, analyzing data and proposing solutions.
- People often have conflicting opinions about the same problem.
- Various organisms and chemical factors indicate the health of an ecosystem, including temperature, turbidity, pH, and other water-quality indicators.
- Human actions and natural systems are interconnected and can affect an ecosystem.
- Systems thinking can help us solve complex problems. .



Learning Pathway

- Learn about a problem of water quality and use a virtual fish tank to test one hypothesis.
- Interview the stakeholders involved in the controversy
- Conduct a series of virtual science experiments based on other factors of water quality.
- Build a scientific model by matching claims to evidence.
- Construct a possible solution to the problem.
- Use a simulator to test the solution, explore the consequences, and make adjustments.
- Craft a report, describing and defending the final solution.

Things to know before you start

This unit will provide opportunities for students to make decisions based on balancing opinions versus facts and interpreting complex water-quality indicators such as pH, turbidity, and eutrophication. Students should have experience writing paragraphs and be able to read and write at a 5th grade level or above. They should have the skills to read and interpret data and detailed descriptions.



Unit Missions

Intro: *Getting Started*

Mission 1: *Stand back! I'm going to try science!*

Mission 2: *Exploring your Options*

Fishers: *How Many Is Enough?*

Loggers: *Muddy Waters*

Farmers: *Water Bloom*

Explore: *Making Decisions*

Outro: *What Happens Now?*

Students will work through these missions in any order they choose.



Students are provided with virtual assistance like this Chain of Reasoning Tool to help them test hypotheses and develop strong arguments!

Critical Moments

- Students will gain virtual hands-on experience in how to manipulate and understand water-quality factors when they work with the Remix Virtual Fish Tank.
- Students will understand the nature of systems thinking as they grapple with the conflicting agendas of the stakeholders in Taiga National Park.
- Students will understand the fragile nature of ecological systems and that many are interconnected, recognizing that one change impacts the entire system, after using a simulator to “see” the impact of their recommendations in a virtual future.



Planning Notes and Timeline

Organizing your implementation

Every classroom's situation is unique, so it is difficult for an outsider to suggest the best way to implement a multi-day unit such as *Mystery of Taiga River*. The length of the classroom period, the accessibility of computers, students' comfort level in a 3D game environment... Many factors will impact the amount of time it will take to complete this unit.

We have provided a sample 15-day timeline below as just one example of an implementation. This guide was developed for a seventh-grade class in a period of 50–75 minutes, meeting daily, and with access to a computer lab or laptops for every student. It assumes that students can spend part of the period on computers and the remainder in the classroom, where the teacher can support their learning. The timeline can be adapted for whatever works for your unique setting and classroom needs.

Optional 15-Day Timeline

NOTE: See each mission's guide for specific ideas on supporting the game.

DAY	Computer	Classroom	DAY	Computer	Classroom
1	<ul style="list-style-type: none"> • Pre-Mission <ul style="list-style-type: none"> • Create your avatar • Meet the Remixers • Learn about the task • Begin Mission One 	<ul style="list-style-type: none"> • Create students' Field Notebooks (p. 28) • DAILY: Discuss progress in game with Taiga Field Notebooks 	11	<ul style="list-style-type: none"> • EXPLORE: Making Decisions mission • Give Bartle your recommendation • Use "Simulator" to see the consequences • Report 2: Who is to blame? 	<p>Assessment</p> <p>⇒ OPTIONAL: Review Complex Text Summaries</p>
2	<ul style="list-style-type: none"> • Mission One <ul style="list-style-type: none"> • Meet Ranger Bartle • Investigate acid rain/pH • Report 1: The Acid Rain Failure 	<ul style="list-style-type: none"> • Support student learning with the Chain of Reasoning Tool (p. 29–32) 	12	<ul style="list-style-type: none"> • Complete Explore: Making Decisions mission • Begin What Happens Now? mission • Report 3: Here from There • Visit the park 5 years into the future 	<ul style="list-style-type: none"> • Regulations & Results lesson, (p 45–46) <p>Assessment</p> <p>⇒ Assess Online Report 2</p>
3–4	<ul style="list-style-type: none"> • Finish Mission One • Begin Mission Two <ul style="list-style-type: none"> • Visit all stakeholders • Choose whom to investigate 	<ul style="list-style-type: none"> • OPTIONAL: pH Indicators (p. 33–34) <p>Assessment</p> <p>⇒ Assess Online Report 1</p> <p>⇒ Re-assess revised reports</p>	13	<ul style="list-style-type: none"> • Continue What Happens Now? Mission 	<p>Ongoing Assessment</p> <p>⇒ Assess Online Report 3</p> <p>⇒ Re-assess revised reports</p>
5	<ul style="list-style-type: none"> • Finish Mission Two • Begin the Free Explore missions (in selected order) <ul style="list-style-type: none"> • Fishers: overfishing • Loggers: turbidity • Farmers: eutrophication 	<ul style="list-style-type: none"> • Fact versus Opinion (p 35) • Evidence Evaluator (p. 36–38) <p>Ongoing Assessment</p> <p>⇒ Assess Online Report 1</p> <p>⇒ Re-assess revised reports</p>	14	<ul style="list-style-type: none"> • Finish the Game <ul style="list-style-type: none"> • Allow time for all students to catch up. • Assign peer helpers if needed. 	<ul style="list-style-type: none"> • Guided Reflection Discussion (page 47) <p>Ongoing Assessment</p> <p>⇒ Re-assess revised reports</p>
6–10	<ul style="list-style-type: none"> • Continue to Explore : <ul style="list-style-type: none"> • Fishers: overfishing • Loggers: turbidity • Farmers: eutrophication • OPTIONAL: Explore: Making Decisions Mission 	<ul style="list-style-type: none"> • Small group work on CoR for fishers, farmers, or loggers (page 29, with worksheets 39–40, 41–42, or 43–44) <p>Ongoing Assessment</p> <p>⇒ Re-assess revised reports</p>	15	<ul style="list-style-type: none"> • Wrap-up <ul style="list-style-type: none"> • Computer time for students still needing to finish 	<p>Final Assessment</p> <p>⇒ Administer Post test</p>



Student Preparation

"When we try to pick out anything by itself, we find it hitched to everything else in the universe."

-John Muir



1 class period

Big Ideas

- People often have conflicting opinions about the same problem.
- Scientists can observe and record observations to guide them in scientific problem solving.

Pre-Mission Overview

This guide contains information on creating a notebook to use in the computer lab, as well as discussion prompts to use after the Remixer pre-mission in-game narrative.

The Remixers prepare the player to travel to Taiga National Park to take on the role of Water Quality Scientist and help Ranger Bartle discover why the fish population of Taiga River is declining.

In order for students to be best positioned as agents of change in this situation, we provide teachers with a reproducible "field notebook" to assemble with students for their in-game use in taking notes and recording their impressions as they play.

This notebook can serve as a powerful tool for students as well as evidence of learning gains that teachers may want to review.

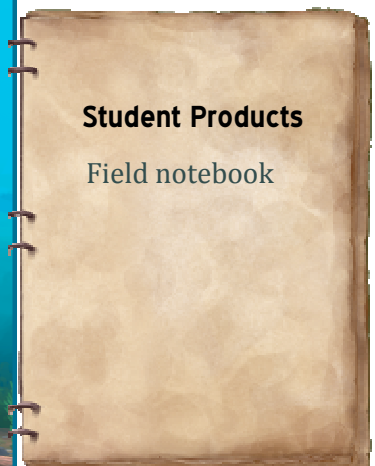


Concepts & Terms

- Water quality
- Scientific inquiry
- Field investigator

Student Products

Field notebook



Background Information

Positioning students as part of the story

Mystery of Taiga River seeks to give students a sense of presence within the space of a national park by positioning them as Water Quality Scientists acting as field investigators. By taking on the scientist's persona, students enter the space with a feeling of identity, purpose, and importance. They aren't there simply to look around, but to impact the space around them.

Their impact in the world is made evident by some of the REACTIONS that characters give them, according to the responses and actions they choose.

They find that they sometimes disappoint NPCs, sometimes please them, but always... ALWAYS make an impact!



Players enter the world of ARX through the Remixer Hub. There, they create their own avatar and gather some high-tech tools before heading off to their first adventure.



Tip!

You may wish to have the **Taiga Field Notebooks** (page 34) created before beginning the online game.



Ranger
Bartle

Using Notebooks in Science

Many teachers use journals in one or two subject areas, but most especially in language arts. A language arts journal serves as an end in itself, with entries graded on their merits as a form of written communication.

But the **Taiga Field Notebook** is better used as a tool for students to clarify their thinking, develop their own writing and thinking styles, and record their observations in *Mystery of Taiga River*, to reflect how the experiences affect them personally. See the activity introduced on the next page to have students create their own field notebook tool for this game. Every mission chapter of this guide includes class discussions related to the notes they take along the way.

Pullout Sheet: Supporting the Remixer Introduction

Mission Tasks

- ◇ Introduction
- ◇ Create your avatar
- ◇ Get your own Remixer Device
- ◇ Use your Remixer Device
- ◇ Get your backpack
- ◇ Collect energy orbs and deliver them to Adam
- ◇ Talk to Gatekeeper Adam
- ◇ Start the teleporter

Lesson Plan!

Your students will get more from the game experience if they have a means to take notes as they play. The **Taiga Field Notebook** is a small booklet students can use to record their reactions and make notes. It's also a great tool for assessment... and a keepsake as well!

Look for instructions to create
and introduce it in:
Appendix A—page 28



Players begin *Mystery of Taiga River* not in the park, but in the **Remixer Hub**, headquarters of the Remixers, a council of teens and young adults who travel across different worlds, helping to solve problems of global significance.

Your students learn about a world in trouble when they sign in at Remixer headquarters. Remixer scientist Theodore tells them that a park ranger has sent out a call for help in a problem that threatens to close the park.

Before they can head out and tackle this problem, they will need to create their avatars and collect some tools they will use along the way.

Players then travel to Taiga National Park to help Ranger Bartle solve his problem.

This is just the one of many adventures in store for your students as they explore the world of **Atlantis Remixed!**



*Theodore, the
Remixer
Science Expert*

Let's Talk about It!

Before students get caught up in the exciting events at Taiga National Park, take a few moments to debrief what they know about the Remixers and their own hidden agenda during their assignment in this world. The following prompts are provided to get this discussion started. Encourage students to make notes in their **Taiga Field Notebooks**.

- Who are the Remixers? What do they do?
- Name some of the Remixers you met. What do you know about them?
- What is a recruit? Why do you think the Remixers called you that?
- What problem are Remixers dealing with right now? What might be some of the consequences to the world if this problem isn't solved?



A Final Thought Seeing versus Observing

The Field Notebook just assembled has been carefully crafted to aid students in organizing their thoughts on all of the content they will encounter in *Mystery of Taiga River*. Many of science's most important breakthroughs, from the discovery of microorganisms to the theory of evolution, have come about through observation. The scientist's gaze is clearly a powerful tool for making sense of how the world works. But seeing is not the same thing as observing. As practiced by scientists, observation is a rigorous activity that integrates what the scientists are seeing with what they already know and what they think might be true. Scientists and naturalists who record observations usually include specific details, with lots of adjectives, adverbs, and even sketches, when they write about their observations (especially outdoors).



Mission Resources

This collection of resources may include background for teachers and students as well as additional activities that support or extend the learning of this chapter of the guide. None are required for completion of the mission. At the time of publication all URLs were current.

INTERNET LINKS

Several commercial websites offer images of a variety of personal journals. You may wish to project some of these images during the activity on page 4. Links aren't intended for student use.

USA Pad: <http://www.usapad.com/>

Aspinal of London: <http://www.aspinaloflondon.com/eshop-catalogue/albums-and-books/leather-journals>

Darwin Online (with images from his notebooks): http://darwin-online.org.uk/EditorialIntroductions/vanWyhe_notebooks.html



BOOKS and LITERATURE

You might also want to share examples of published journals and notebooks such as the following (most can be found at a public or school library).

- Ambrose, Stephen A. *The Journals of Lewis and Clark*, Revised Edition. Mariner Books, 1997
- Leonardo da Vinci. *The Notebooks of Leonardo da Vinci*. Oxford University Press, USA (January 28, 1999)
- Weeks, John. *Nature's Quiet Conversations*. Syracuse University Press, 2006.
- House, Homer. *Wildflowers of New York*. University of the State of New York, 1918.



Stand back! I'm going to try science!



1-2 class periods

Big Ideas

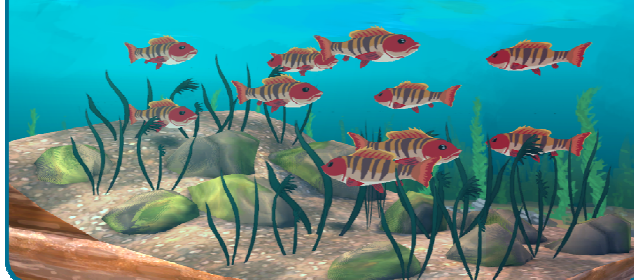
- People often have conflicting opinions about the same problem.
- A hypothesis is only a tentative explanation for a phenomenon used as a basis for further investigation.
- Hypotheses should be based on evidence and written in a way that is testable.

Mission Overview

In mission one, players meet key characters in Taiga National Park, including park superintendent Ranger Bartle, his intern Jesse, and the three members of the National Park Council, who are judging Bartle's ability to solve the problem of the dying fish.

But before they can start their own investigation, Bartle greets players with the news that his colleague John Lim, manager of the Taiga Park Visitor's Center, has a theory about the problem that doesn't blame anyone at the park... acid rain!

They head off to meet with Manager Lim and begin their first water quality investigation to determine whether low pH levels are killing the fish in Taiga River.



Concepts & Terms

- Hypothesis
- Observation
- Water quality
- pH
- Acid Rain
- Pollution

Student Products

Field notebook

Report 1:

* The Acid Rain Failure

*See Appendix D, page 52, for scoring help.

Background Information

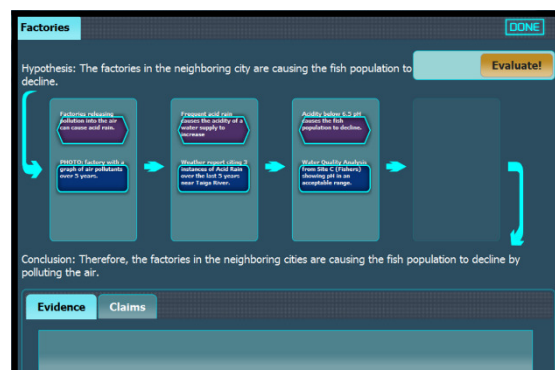
Scientific Models

Mystery of Taiga River continues the Atlantis Remixed tradition of teaching students the importance of building strong arguments. In science, that not only involves gathering trustworthy data to test a hypothesis, but laying out that data in a logical sequence, supported by facts, through a scientific model. Scientist Abbie gives students a tutorial on this concept in mission one, and it is repeated at least three more times throughout the game.

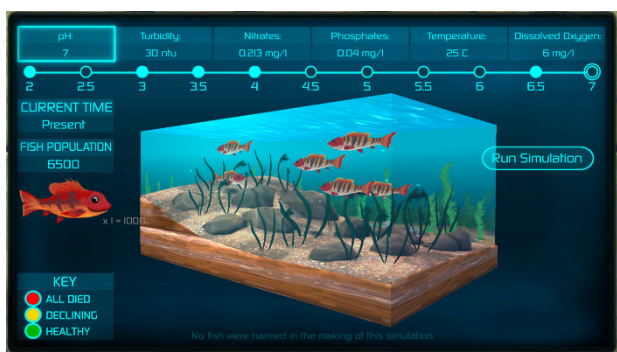


The Chain of Reasoning Tool

Abbie uses pH in mission one as a simple example of how the tool works. Players drag-and-drop CLAIMS (purple tiles) into the chain to construct a logical arguments, and then pair those claims with EVIDENCE (blue tiles) that prove the claims apply to Taiga's situation. If their argument is sound and the claims are proven, the arrows turn green. Only a strong chain of reasoning can create an acceptable scientific model and serve to identify the best solution to the dying fish problem.



The Chain of Reasoning Tool



Remixer Virtual Fish Tank

(See more about this on page 4)



Tip!

Encourage students to use their Taiga Field Notebooks as they navigate mission one online.



Abbie,
Taiga Park
Scientist

What teachers should know about pH

pH refers to the amount of hydrogen ions in a solution (such as aquatic water). pH is measured on a scale of 1–14, with the numbers below 7 indicating an acidic (many hydrogen ions) solution, and numbers above 7 being alkaline or basic (fewer hydrogen ions and more hydroxide molecules,). A pH of 7 indicates a balance between the two.

Students learn about the pH scale as they work with Abbie in her hidden cave laboratory. In this activity, they discuss acids, bases, and neutrals. Another word for basic in this context is alkaline. Citrus and other acidic fruits usually are about pH 4. Soaps are weak bases (or alkalis), at about pH 9 to 10. Fertile or healthy soil or water range from pH 6.5 to 7.5. *NOTE: For more information on this and other science in Taiga, see Appendix E.*

Pullout Sheet: Supporting Mission One

Mission Tasks

- ◇ **Construct Hypothesis:**
 - ◇ Meet Ranger Bartle
 - ◇ Talk to Manager Lim
- ◇ **Test Hypothesis:**
 - ◇ Collect water sample
 - ◇ Science Center
 - ◇ Abbie's Cave
 - ◇ Virtual Fish Tank
- ◇ **Evaluate Hypothesis:**
 - ◇ Build your argument
 - ◇ Report back to Bartle

Lesson Plan!

In mission one students are thrown right into science experimentation, using two virtual tools to help them determine whether acid rain and low pH levels are really the culprits in the Taiga River problem.

Look for two lesson plans in Appendix A to support student understanding of the Chain of Reasoning Tool (pp 29–32) and pH indicators (pp 33–34).

Upon arrival in Taiga National Park, players enter the Ranger Station in front of them to find Ranger Bartle and learn more about the problem he reported in the letter for help he sent out.

They discover the ranger in the midst of a video conference with three members of the National Parks Council, who are overseeing how he handles the problem of the dying fish population.

During a brief discussion with the ranger, he tells them that he may already have the solution... John Lim, Manager of Taiga's Visitor Center, has a theory that the water quality problem can be traced back to acid rain caused by factories in the nearby towns. They talk with Lim and gather two documents, which they examine with their Lenses of Lumination Goggles to locate facts to place in their NOTEBOOKS.

Then they gather a water sample from the fishing camp across the road and analyze it at the Science Center to discover just what the pH levels are in Taiga River. When they find park scientist Abbie, they will get their first taste of two in-game tools: The Remixer VIRTUAL FISH TANK and Abbie's CHAIN OF REASONING (CoR) Tool.

The mission ends with players writing a report: **The Acid Rain Failure**, describing how they arrived at their conclusions about acid rain as a source of the problem.

Teachers can review this report in the Teacher Toolkit, online.

*John Lim, Manager of
Taiga's Visitor Center*



Let's Talk about It!

Have students gather in groups with their hardcopy **Taiga Field Notebooks**, turned to their notes from mission one, to discuss their experiences so far in *Mystery of Taiga River*. The following prompts can be used to guide further discussions of mission one.

- The situation at Taiga National Park is related to the quality of water in Taiga River, and how that water has affected the rare Taiga fish... A species only found here. What was Manager Lim's idea about the cause of the problem?
- What did Lim fail to do to make his case to Ranger Bartle?
- What was the most difficult part of completing your investigations with Abbie?
- What did the test prove? If there isn't a pH problem in Taiga River, what conclusions can you draw about the pollution coming from factories in nearby towns? Explain your reasoning.





A Final Thought

The Remixers' Virtual Fish Tank

As science teachers know, the best way for students to learn about the factors of water quality (pH, dissolved oxygen, turbidity, etc.) is for them to conduct hands-on experiments with the levels. *Mystery of Taiga River* lets students do just that... In a virtual way.

Remixer Theodore gives players their own Virtual Fish Tank in mission one, stocked with plenty of the rare Taiga Fish. They use this to change the water quality in a controlled manner, viewing the impact on the fish population in the tank, until they construct their own knowledge about acceptable ranges of each factor.

Another benefit to a virtual fish tank? As it says on the model, *No fish were harmed in the making of this simulation!*



Mission Resources

This collection of resources may include background for teachers and students as well as additional activities that support or extend the learning of this chapter of the guide. None are required for completion of the mission. At the time of publication all URLs were current.

INTERNET LINKS

<http://www.rcc.nsw.gov.au/images/2007/pH%20Scale.jpg>

pH Table

Print this full-color pH scale to project or use in Classroom Activity 1 (see Appendix A)

<http://www.epa.gov/acidrain/education/experiments.html>

Science Experiments: Acid Rain

Visit this site of the Environmental Protection Agency for ideas about classroom experiments on pH, acid rain, and pollution.

<http://www.pbs.org/teachers/connect/resources/2087/preview/>

Weebit World

In this online reasoning interactive, students must produce the largest number of weebits. Adjust variables to determine how fast plants grow, and then feed the plants to weebits to cause the weebits to multiply.





Exploring Your Options



1-2 class periods

Big Ideas

- People often have conflicting opinions about the same problem.
- It is important to gather information to learn more fully about a problem.

Mission Overview

In mission two, players set out to meet the stakeholders who impact and are impacted by the health of the river habitat at Taiga National Park: K-Fly Fishing Camp, Build-Rite Lumber Company, and Green Leaf Farms.

By touring the park and gathering the opinions of each of these stakeholders, students get a quick overview of the factors that might be impacting the river habitat and killing the fish.

They assemble these opinions, and, at Ranger Bartle's insistence, postulate which problem MIGHT be the greatest threat. They learn the importance of careful adherence to the scientific method when the ranger seizes this preliminary opinion and rushes to the council with this "solution" to the mystery.



Concepts & Terms

- Cause/Effect
- Fact/Opinion

Student Products

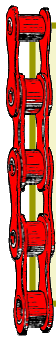
Field notebook

Background Information

Systems Thinking in Scientific Problem Solving

Systems thinking is a framework that is based on the belief that problems do not exist in isolation but rather that surrounding elements—politics, society, the environment, the passage of time, and so on interact with each other and act upon the problem. The component parts of a system can best be understood in the context of relationships with each other and with other systems, rather than in isolation. Changing any one part of the system can have effects on the other parts.

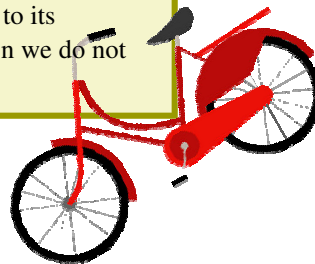
The purpose of *Mystery of Taiga River* is to give students, through the narrative of a declining fish population at a national park, the ability to see parts of the problem in relation to the whole. They will find several interested groups, each of which is first, convinced that they are blameless in the problem and second, eager to point the finger at others.



Whole or Parts?

Systems thinking tells us that a bicycle is only useful as a vehicle when it is considered as a whole, rather than a collection of its parts.

The importance of each part of the bicycle is tied to its relationship to the whole. Looking at it in isolation we do not get a realistic picture of the part's importance.



Tip!

Encourage students to use their Taiga Field Notebooks as they navigate mission two online.



Claim _____
Source _____

1. click below to rate the trustworthiness of this claim and source:

SPECULATIVE MISQUOTED OTHER RELIABLE FACT

2. Claim + Trust = Evidence. Based on your answer to #1, would you call this claim strong EVIDENCE?

☐ Yes ☐ No

3. Which stakeholder does this evidence accuse?

☐ Farmers ☐ Fishers
☐ Loggers ☐ Factories (Acid Rain)

4. Does this evidence strongly support the thesis that Fishers are to blame?

☐ Yes ☐ No

DONE

Another tool in the game helps students decide if statements they gather can be considered real evidence.



The Taiga Park Council

Adversarial Partners in the Taiga Park System

There are lots of characters with lots of different ideas about the problem at Taiga National Park and how to solve it. See Appendix B of this guide for a list of these characters and their personal opinions and agendas.

Check in with your students as they navigate the space in this second mission to be sure they can identify the groups and that they understand each group's or character's position in regards to the problem, an important step in systems thinking.

Pullout Sheet: Supporting Mission Two

Mission Tasks

- ◇ Catch up with Ranger Bartle
- ◇ Meet the Fishers
- ◇ Meet the Farmers
- ◇ Meet the Loggers

Lesson Plan!

In the second mission in Taiga National Park, your students will encounter a lot of characters, all giving them advice on the source of the problem in Taiga River. Many of these statements will be facts, but a lot of them will be nothing more than opinion.

For a quick lesson in distinguishing fact from opinion in dialogues, see a lesson plan in Appendix A—page 35

Another lesson on this topic can be found on pages 36–38, where students learn about another tool in the game that helps them analyze statements as evidence.

Ranger Bartle is disappointed that Manager Lim's idea about acid rain and low pH levels didn't pan out, but he's not ready to give up yet! He asks players to go out and meet the three groups who are the biggest stakeholders in the health of the river habitat: Green Leaf Farms, K-Fly Fishing Camp, and Build-Rite Lumber Company. After collecting statements from members of each group, they return to Bartle.

Bartle asks players, based on what they've gathered so far, to hypothesize on the group that has had the MOST effect on the fish in Taiga River.

When they select one group based on the conversations they've had during this mission, he sends them off on an EXPLORE mission to investigate that group further. Mission two ends there.

NOTE: The following missions in Mystery of Taiga River are interchangeable... the students in your classes will probably be working with different data and at different rates. The next chapter of this guide will help you support their investigations of the fishers, farmers, and loggers.



Jesse, Taiga's
Junior Ranger



Let's Talk about It!

Have students gather in groups with their hardcopy **Taiga Field Notebooks**, turned to their notes on the second mission of *Mystery of Taiga River*. The following prompts can be used to guide discussions of mission two.

- Who are the main groups involved or concerned with the problem? How do the different groups use the limited resources?
- How does the problem affect each group: does it seem to be positive, negative, or of no impact?
- Have the groups involved become *adversaries*? Describe the conflicts and their causes.
- Do you think the groups can get together and solve this problem without assistance? If you don't intervene, what do you think will happen?



A Final Thought

Opinions in Scientific Investigations

The opinions given by characters in mission one slant heavily toward blaming the fishers for the fish decline problem. This is by design, as it serves to emphasize that uninformed opinions can lead to poor decisions.

Ask students who they blamed and why after they make the choice with Ranger Bartle at the end of the mission. Did they find some opinions more trustworthy than others? If so, why?



Mission Resources

This collection of resources may include background for teachers and students as well as additional activities that support or extend the learning of this chapter of the guide. None are required for completion of the mission. At the time of publication all URLs were current.

INTERNET LINKS

<http://www.pbs.org/wgbh/nova/typhoid/detective.html>

Disease Detective

Emulate an epidemiologist by interviewing witnesses, filling out a graphic organizer, and using logical reasoning skills. Identify the source of an unknown disease in this interactive medical mystery from PBS NOVA.

<http://www.sikeston.k12.mo.us/mapattack/6th/cz04.ppt#300,3,Slide 3>

Fact or Opinion Jeopardy!

This PowerPoint classroom game, created by a sixth-grade teacher in Missouri, can be used to help middle school students differentiate between fact and opinion on statements related to a variety of pop culture topics. Save the file and turn it into a slide show to use with your class.



Books and Literature

Systems Thinking Basics

Anderson, Virginia and Lauren Johnson. *Systems Thinking Basics: From Concepts to Causal Loops*. Pegasus



Players' Choice: Investigate the...



3–5 class periods

Big Ideas

- People often have conflicting opinions about the same problem.
- A hypothesis is only a tentative explanation for a phenomenon used as a basis for further investigation.
- Hypotheses should be based on evidence and written in a way that is testable.

Mission Overview

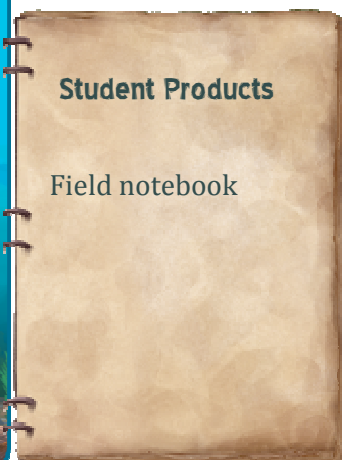
Players are given the freedom to choose their next course after they complete mission two, so teachers may find their students in different situations and completing differing tasks as they work through the water quality investigations with farmers, loggers, and fishers. In this chapter, you will find pull-out sheets for all three of these trajectories.

The purpose of this self-selecting portion of the game is to provide players with agency, not forcing them to complete *Mystery at Taiga River* in a particular order. In fact, along the way they can stop after investigating any group and tell Ranger Bartle they think they know the solution, thereby launching the EXPLORE mission. See the next chapter for more about that possibility.



Concepts & Terms

- Turbidity
- Sediment
- Dissolved Oxygen
- Nitrates
- Phosphates
- Eutrophication
- Overfishing
- Fish Nests
- Spawning Season



Background Information

Water Quality

"Look after the water and the fish will look after themselves" is a quotation often mentioned in the fishing industry, because water quality is one of the most important aspects of fish health. In these three EXPLORE missions, students will identify and investigate several issues of water quality, including the following.



Erosion and Sediment

Once soil is washed into the water, it is considered **sediment** (solid particles in water). Sediment commonly enters water through a process called **erosion**, when wind or runoff carries loose soil into water. Human activities that disturb soil or plant roots can cause erosion.



Dissolved Oxygen, Temperature and Turbidity

Sediment can affect several water quality indicators. When sunlight strikes sediment suspended in the water, its heat warms the particles, which in turn raises the **temperature** of the water. Warm water can hold less **dissolved oxygen** than cold water can, so dissolved oxygen levels decrease as a result. Because suspended sediment intercepts light, it lowers visibility in the water, increasing **turbidity**.

Tip!

Encourage students to use their Taiga Field Notebooks as they navigate these three missions online.

Nutrient Run-off, Eutrophication, and Algal Blooms

Nitrates and phosphates are the chemical forms of nitrogen and phosphorus preferred by most plants. They are soluble in water and are taken up by plant roots. But because they are so easily dissolved in water, excess amounts of these **nutrients** can leach (wash out of the soil) into streams.

Eutrophication is the rapid growth of aquatic plants and algae that can occur when water is over-enriched by nutrients (excess fertility).

The first result of the excess of nutrients, mentioned above, is the overgrowth of algae. Phosphorus stimulates the growth of algae causing **algal blooms** (large mats of algae), which choke out other aquatic life. At the same time, dissolved oxygen (DO) is used up as dead algae and larger plants decompose and the organisms that live off of decomposed matter use up the limited DO supply.



Maria and
José, Park
Visitors

NOTE: For more information on these and other sciences in Taiga, see Appendix E.

Student Agency in Transformational Play

We didn't have to provide students with the agency to make their own choices in this part of Mystery of Taiga River. In fact, it would be easier to design a game in which the tasks students follow are carefully laid out. That way we can keep track of what they have learned and when, making the design easier (and making it easier for teachers as well, to understand where their students are in the trajectory!).

But our commitment to transformational play ensures that your students feel like they are in control of their own learning during this game... They can choose whom they will investigate first, and they can choose when they believe they have enough data to come up with a solution. By positioning students as CHANGE AGENTS, we empower them with the control of their own learning.

Pullout Sheet: Supporting Mission Three

Mission Tasks

- ◇ **Construct Hypothesis:**
 - ◇ Check in with Abbie
- ◇ **Test Hypothesis:**
 - ◇ Find fish spawning info
 - ◇ Talk to Melinda at K-Fly Fishing
 - ◇ Get photos at K-Fly
- ◇ **Evaluate Hypothesis:**
 - ◇ Build evidence chain with Abbie
 - ◇ Evaluate fishing consequences

Lesson Plan!

In the Fishers mission, players work with Abbie to test the hypothesis that the K-Fly fishers are causing harm to river habitat through their **fishing** practices.

Appendix A provides another student worksheet and lesson for supporting the Chain of Reasoning Tool for Overfishing—See pages 39–40.

In addition, check Mission Resources on page 18 for a helpful video on fish spawning problems.

Fishers: How Many Is Enough?

Players who choose to investigate the fishers will be looking into the question of whether they are either **overfishing** the river, or putting young Taiga Fish at risk by **interfering with spawning season** during their annual fishing tournament.

After checking in with Abbie to get her advice on what to do first, players are sent off to:

- Collect information about the Taiga Fish's spawning season from the Ranger Station (*Use LOL Goggles to evaluate*);
- Talk to Melinda at K-Fly to gather her statements and any evidence she has about their operations; and
- Use the nearby VIEWFINDER to collect photographic evidence about the fishers at **Site C** (see picture on page 13)
- *NOTE: For this mission, players don't need to collect or test a water sample. They performed this test during mission one, and overfishing doesn't affect water quality.*

With this new evidence in hand, players return to Abbie to conduct experiments with the Virtual Fish Tank once again.

With the final data about how removing parents during spawning season affects the young Taiga Fish, players are ready to try out the Chain of Reasoning (CoR) Tool once again.

Once this is completed, players return to Bartle and do one of two things:

- Select another group to investigate, OR
- Choose to set regulations for this group and begin **Making Decisions**.

(NOTE: The second choice launches that EXPLORE mission.)

Melinda of
K-Fly Fishing



Let's Talk about It!

Have students gather in groups with their hardcopy **Taiga Field Notebooks**, turned to their notes on the **fishers**. You might want to break the class into groups, based on the EXPLORE mission they worked on today, and have them discuss their experiences. (NOTE: All groups will consider the same five questions, as they apply to their group.)

- What hypothesis were you working on to blame the fishers?
- Were you able to complete a chain of reasoning to make this conclusion?
- Which claims had strong support?
- Which claims had weak support?
- What conclusions CAN you draw from your investigations so far?
- Have you learned enough to go to Ranger Bartle with a solution? What happens next?



Pullout Sheet: Supporting Mission Four

Mission Tasks

- ◇ **Construct Hypothesis:**
 - ◇ Get advice from Abbie
- ◇ **Test Hypothesis:**
 - ◇ Get photos near Build Rite
 - ◇ Get water sample near Build Rite
 - ◇ Talk to Director Dee
 - ◇ Visit the Science Center
- ◇ **Evaluate Hypothesis:**
 - ◇ Build evidence chain with Abbie
 - ◇ Evaluate turbidity consequences

Lesson Plan!

In the Loggers mission, players work with Abbie to test the hypothesis that Build Rite Lumber may be causing **turbidity** in Taiga River, causing low levels of dissolved oxygen and suffocating the fish.

Appendix A provides another student worksheet and lesson for supporting the Chain of Reasoning Tool for Turbidity—See pages 41–42.

In addition, check Mission Resources on page 18 for a helpful video on measuring turbidity.

Loggers: Muddy Waters

Players who choose to investigate the loggers will be looking into the question of whether they are harvesting trees too close to the river, creating **erosion**, **sediments**, and lowered levels of **dissolved oxygen** in the river.

After checking in with Abbie to get her advice on what to do first, players are sent off to:

- Use the nearby VIEWFINDER to collect photographic evidence about the loggers (see picture on page 13).
- Collect a sample of water for Site B;
- Talk to Director Dee to gather any evidence she has about their operations; and
- Collect information from a poster on sediment, from the Science Center (Use LOL Goggles to evaluate).

With this new evidence in hand, players return to Abbie to conduct experiments with the Virtual Fish Tank once again.

With the final data about how removing parents during spawning season affects the young Taiga Fish, players are ready to try out the Chain of Reasoning (CoR) Tool once again.

Once this is completed, players return to Bartle and do one of two things:

- Select another group to investigate, OR
- Choose to set regulations for this group and begin **Making Decisions**.

(NOTE: The second choice launches that EXPLORE mission.)

Director Dee and Buck of Build Rite Lumber



Let's Talk about It!

Have students gather in groups with their hardcopy Taiga Field Notebooks, turned to their notes on the **loggers**. You might want to break the class into groups, based on the EXPLORE mission they worked on today, and have them discuss their experiences. (NOTE: All groups will consider the same five questions, as they apply to their group.)

- What hypothesis were you working on to blame the loggers?
- Were you able to complete a chain of reasoning to make this conclusion?
- Which claims had strong support?
- Which claims had weak support?
- What conclusions CAN you draw from your investigations so far?
- Have you learned enough to go to Ranger Bartle with a solution? What happens next?



Pullout Sheet: Supporting Mission Five

Mission Tasks

- ◇ **Construct Hypothesis:**
 - ◇ Get advice from Abbie
- ◇ **Test Hypothesis:**
 - ◇ Get photos near Green Leaf
 - ◇ Get water sample near Green Leaf
 - ◇ Ask Nola for more information
 - ◇ Pick up more data at the Science Center
- ◇ **Evaluate Hypothesis:**
 - ◇ Build evidence chain with Abbie
 - ◇ Evaluate eutrophication consequences

Lesson Plan!

In the Farmers mission, players work with Abbie to test the hypothesis that Green Leaf's actions are causing **eutrophication** in Taiga River.

Appendix A provides another student worksheet and lesson for supporting the Chain of Reasoning Tool for Eutrophication—See pages 43–44.

In addition, check Mission Resources on page 18 for a handy 90-second animation on eutrophication.

Farmers: Water Bloom

Players who choose to investigate the farmers will be investigating the idea that the farmers are polluting the river with **nutrient** run-offs that causes **eutrophication**.

After checking in with Abbie to get her advice on what to do first, players are sent off to:

- Collect information from a poster on eutrophication, from the Science Center (*Use LOL Goggles to evaluate*);
- Talk to Nola and Norbert to gather any evidence they have about their operations; and
- Collect a sample of water for **Site A**.
- Use the nearby VIEWFINDER to collect photographic evidence about the farmers (see picture on page 13).

With this new evidence in hand, players return to Abbie to conduct experiments with the Virtual Fish Tank once again.

With the final data about how nutrient run-off from animal waste and fertilizers affects water quality, players are ready to try out the Chain of Reasoning (CoR) Tool once again.

Once this is completed, players return to Bartle and do one of two things:

- Select another group to investigate, OR
- Choose to set regulations for this group and begin **Making Decisions**.

(NOTE: The second choice launches that EXPLORE mission.)

Nola and Norbert of
Green Leaf Farms



Let's Talk about It!

Have students gather in groups with their hardcopy Taiga Field Notebooks, turned to their notes on the **farmers**. You might want to break the class into groups, based on the EXPLORE mission they worked on today, and have them discuss their experiences. (NOTE: All groups will consider the same five questions, as they apply to their group.)

- What hypothesis were you working on to blame the farmers?
- Were you able to complete a chain of reasoning to make this conclusion?
- Which claims had strong support?
- Which claims had weak support?
- What conclusions CAN you draw from your investigations so far?
- Have you learned enough to go to Ranger Bartle with a solution? What happens next?



A Final Thought

Common Misconception: Each Stakeholder affects only the habitat near them

Many students don't notice that Site C (K-Fly Fishing Company) is downstream from sites A and B (Green Leaf and Build Rite). This might be a good time to examine the map of Taiga (a projected copy from Appendix C or the one found in students' Taiga Field Notebooks) and ask students to find the sites on the map.

Ask probing questions to get them thinking about how the topography may play into their findings.



Mission Resources

This collection of resources may include background for teachers and students as well as additional activities that support or extend the learning of this chapter of the guide. None are required for completion of the mission. At the time of publication all URLs were current.

INTERNET LINKS: Videos

<http://video.nationalgeographic.com/video/news/animals-news/us-grunion-spawning-vin/>

Animal News: Fish "Walks" on Beach to Spawn

For FISHERS MISSION: In this video from National Geographic, students can see fish spawning for themselves, and get a better understanding of the predations on the eggs and hatchlings.

<http://nationalzoo.si.edu/Education/ClassroomScience/Turbidity/scientist.cfm>

Settle Down: Turbidity and Water Quality

For LOGGERS MISSION: In this video from Smithsonian National Zoological Park, students learn from a scientist about measuring turbidity with a Secchi Disk. *Includes discussion questions.*

<http://nationalzoo.si.edu/Education/ClassroomScience/Turbidity/scientist.cfm>

Eutrophication Animation

For FARMERS MISSION: This simple, kid-friendly animation takes only 1.29 minutes to simplify the complex cause/effect relationship of nutrient run-off and eutrophication.



MISSION SIX

Explore: Making Decisions



1-4 class periods

**Tied to progress in the previous chapter*

Big Ideas

- Actions taken in the present have future consequences.
- Systems thinking can be used to solve complex issues that develop over time.
- Complex issues are often impacted by multiple perspectives and conflicts among stakeholders.
- Ecosystems are interconnected.

Mission Overview

Once players have investigated at least one group of stakeholders and their effect on the fish population in Taiga River, they will discuss with Ranger Bartle whether they feel that group is to blame and what regulations they feel should be imposed on one or more of the stakeholders. If they choose to blame that group rather than continuing their investigations, this mission is launched. If not, they continue in the previous missions.

This mission is unique for science instruction, in the fact that players can actually see the **CONSEQUENCES** of their decisions. *Mystery of Taiga River* contains a game device that will allow them to view a **simulated future**, based on the regulations they imposed.

After exploring the ramifications of their choices with the simulator, players have the opportunity to change their minds, investigate another group (returning to the previous guide chapter), or validate their original choice before making a final recommendation about what to do to solve the problem of the dying fish population.



Concepts & Terms

- Hypothesis
- Observation
- Regulation
- Overregulated
- Systems thinking

Student Products

Field notebook

Report 2:

* Who is to blame?

Report 3:

* Here from There

NOTE: See Appendix D for scoring help.

Background Information

The Role of Compromise in Systems Thinking

One of the defining characteristics of a system is that different groups, or stakeholders, are competing for a limited resource and view the system from different perspectives. Because of these differing perspectives, many people fall into the mindset that any solution to a problem within a complex system must be a win/lose proposition—that a win for one stakeholder will generally result in a loss for another.



The purpose of this mission is to demonstrate for students that a systems thinking approach should rely on trade-offs and compromise rather than win/lose strategies. They will see that no one group in Taiga benefits more than the others, and that all three groups gave up something to solve the problem.

Taiga National Park
Rules & Regulations

1. Logging Regulations

- ☐ Ban cutting down trees within 300m of the river bed?
- ☐ Require that a tree must be replanted for every tree that is cut?
- ☐ Require that a tree must be at least 20 years old before being cut down?
- ☐ Ban Build-Rite Lumber company from Taiga Park?

2. Fishing Regulations

- ☐ Ban removing more than 2,000 fish from the river within a year?
- ☐ Require that the fishing tournament be moved to after the spawning season?
- ☐ Ban the use of live bait for fishing in Taiga Park?
- ☐ Ban all fishing from Taiga River?

3. Farming Regulations

- ☐ Require that all farm animals be prevented from grazing near the river?
- ☐ Ban the use of fertilizer on Greenleaf Farms?
- ☐ Ban farming within 200 meters of the river bed?
- ☐ Ban Greenleaf Farms from Taiga Park?

Submit

*Imposing Regulations
on Taiga Stakeholders*

Student Freedom while Acquiring Content

Mystery of Taiga River allows students the freedom to jump to conclusions... In other words, even after investigating only one stakeholder group, they can tell Ranger Bartle that they know just what to do to solve the fish problem. What they will discover if they make that decision is that, they can't solve the problem without ALL of the facts!

In the image on this page you see a facsimile of the Regulation Sheet that players fill out at the Simulator. However ONLY those groups they have already investigated (see the previous chapter) will show up here... They cannot impose regulations on a group that they haven't checked out. This ensures that all students learn ALL of the water quality science and systems thinking data available in the game.

Pullout Sheet: Supporting the EXPLORE Mission

Mission Tasks

- ◇ Talk to Ranger Bartle
- ◇ Find the Simulator Device
- ◇ Set regulations and see the results
- ◇ Discover the consequences for the Park Service
- ◇ Discover the consequences for the fishers
- ◇ Discover the consequences for the loggers
- ◇ Discover the consequences for the farmers
- ◇ Make your final recommendation to Ranger Bartle

Lesson Plan!

In this mission players must set **REGULATIONS** on each of the stakeholder groups, limiting their operations in some key areas in the hopes of alleviating the dying fish problem.

Look for a lesson plan in Appendix A to encourage students to predict and discuss what happened to each of the groups when they saw them during the “simulated” future (pages 45–46).

This mission is a tricky one, because it can be repeated several times, and must until your students “get it right.” Consequently, some may finish it quickly while others will repeat it several times.

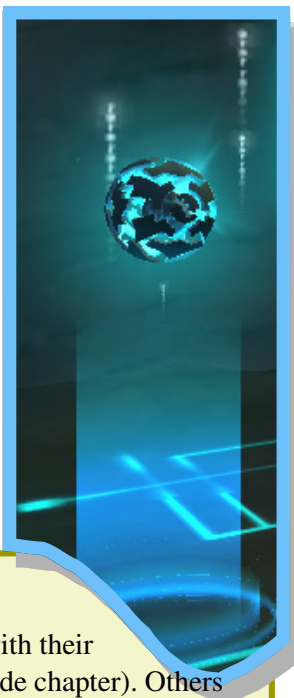
Every time a player investigates one of those stakeholders, they have the opportunity to tell Ranger Bartle that they are the culprits. Bartle will request that they write a report to the council, explaining **WHY** they are to blame (**Report 2** in your Teacher Toolkit).

When the report is submitted, the player and Bartle are discussing their worry that the council won’t agree with the choice. Jesse pipes in with startling news... He found a secret device that will let anyone look at a simulation of the future! Players follow Jesse into the cave in the center of the park to discover the Simulator.

There, Remixer Theodore pops in again with instructions on how to use the machine. Players will **SET REGULATIONS** on each of the stakeholder groups. Then the machine will launch them into a simulated future (obvious because of the look of the world... See the picture on page 19), where they must talk to everyone in the park to see how the choices affected each of them.

After this peek into the future, players can either investigate more groups or make a final recommendation to Ranger Bartle, a decision that is informed by their experiences with the simulator. A Final Report (**Report 3** in your Teacher Toolkit) launches the final mission of this game.

The Simulator



Let’s Talk about It!

Some students will visit the simulated future several times, mixed in with their investigations of the fishers, loggers, and farmers (see the previous guide chapter). Others will wait until they’ve investigated them all and move through the steps of this mission only once, after investigating all three stakeholder groups.

Either way, creating a discussion of this mission is tricky. Instead, you might ask questions as you monitor computer progress, asking one or two questions of students whom you see in the future space. Then wait and debrief the experience with the lesson plan suggestion above. Some questions you might ask individuals in Sim Taiga include:

- How are the fish doing in your simulated future?
- Have you found any stakeholders to be harmed by your regulations? What did they say?
- Are any of the groups pleased by your choices? Why are they happy?





A Final Thought

Time, Continuity, and Change

This mission provides an excellent opportunity for students to explore the concepts of **time, continuity, and change**, important social studies concepts.

You may need to help them understand that each time they alter the regulations on the Simulator, that will alter events in a way that effectively “erase” what they saw during the previous peek into the future.



Mission Resources

This collection of resources may include background for teachers and students as well as additional activities that support or extend the learning of this chapter of the guide. None are required for completion of the mission. At the time of publication all URLs were current.

INTERNET LINKS

http://www.wgvu.org/teacher_resources/pages/heh2o.html

Fast Facts about water

Discover facts about water's chemical properties, weight, temperature and states.

Understand that microorganisms can pollute water and that water is an effective solvent.

http://www.wgvu.org/teacher_resources/pages/heh2o.html

Watersheds Video

Discover the meaning of the term *watershed* with this video from Habitat Earth: H₂O.

Understand how watersheds affect our lives and how our lives affect watersheds.





Outro: What Happens Next?



Instructional Time

1-2 class periods

Big Ideas

- Complex systems are not easy to understand—a variety of approaches may be necessary for a thorough understanding of how a complex system works.
- Solving complex problems involving differing perspectives requires trade-offs and compromise among stakeholders.
- Reflection and re-evaluation are sometimes necessary to create a better solution to a problem.

Mission Overview

This game is unique in science education, in that students are allowed to see immediately the consequences of their decision and choices... Not once, but over and over again until they get it right.

In the final mission, which only occurs when students are satisfied that their regulations for the stakeholders are best for them and for the entire park, players will travel five years into the future to finally see what happened to this world as a result.

They will see that all three stakeholders have made compromises and changes to their usual practices, for the good of the habitat. Using systems thinking and compromise, players have succeeded in solving the *Mystery of Taiga River*!



Concepts & Terms

- Regulation
- Compromise
- Stakeholders
- Systems thinking
- Repercussions

Student Products

Field notebook

Background Information

Metacognition and Systems Thinking

Human beings are the only living organisms that can reflect on their own thinking processes. When confronted with a dilemma or some obstacle, humans draw on their mental resources to plan a course of action, monitor that strategy while executing it, reflect on the strategy while executing it, and then reflect on the strategy once again to evaluate how well it achieved its outcomes.

Mystery of Taiga River is designed to complement these metacognitive approaches. The classroom activities and discussion questions provided throughout this guide have been designed to help teachers facilitate students' reflection and synthesis of the strategies and information developed within the unit. See the suggested lesson plan for this chapter of the guide (introduced on the next page) for a guided reflection activity to wrap up the unit.



Bartle, new member of the Park Council

The Teacher's Role in Atlantis Remixed

Well-designed intergenerational games can create rich mentoring frameworks that facilitate both literacy and high-order thinking skills for young people through interactions with adults. We caution, however, that games—just like books—are not, at their best, stand-alone educational tools, but need to be integrated into well designed learning systems that use a variety of media, real world interactions, and instructional methods.

Mystery of Taiga River is no exception. Students cannot learn all that they need to know about persuasive writing by playing our game. The teacher's role, as you have seen throughout this guide, is vital! **NOTE:** See the activity suggestions on page 58 for additional ways to build upon the writing lessons of *The Doctor's Cure* in the classroom.

Pullout Sheet: Supporting the Outro Mission

Mission Tasks

- ◇ Speak with the Park Ranger
- ◇ Visit Abbie in the Science Center
- ◇ Visit the Green Leaf Farmers
- ◇ Visit the Build Rite Loggers
- ◇ Visit Melinda at K-Fly Fishing
- ◇ Say goodbye to Taiga National Park

Finally... It's time for players to see the REAL results of all their labor! After trying out their ideas with the Simulator in the previous mission, players finalized what they consider to be their BEST solution for the problem. They set the regulations and restrictions for each of the three stakeholder groups, said goodbye, and "left" Taiga National Park.

But instead of returning to Remixer Headquarters, Remixer Theodore teleports them into the park FIVE YEARS into the future... The "real" future this time, not the simulated one. Here they talk to the Park Ranger (*NOTE: Don't tell your students, but expect a surprise here!*), Abbie, and some old friends from K-Fly Fishing Company, Build Rite Lumber, and the Green Leaf Farms.

After seeing the results of their labors, players are teleported out of Taiga National Park and the game ends.



Jesse, Eastman
New Head Ranger of
Taiga National Park!



Let's Talk about It!

In this final mission, students see the results of their actions in solving the problem. It is important that they reflect mindfully on these consequences, so that they cement the understanding gleaned from the experience.

Look for a guided reflection lesson plan in Appendix A to support student reflection, on page 47.



A Final Thought

Atlantis Remixed and Teaching through Games

Mystery of Taiga River is intended to position players as protagonists in a game world where they must use their understanding of the scientific method and systems thinking in their role of Water Quality Scientist. In this role and in the fictional world, we hope that your students have come to experience disciplinary content as personally relevant and socially important.

We welcome you to try out other content from Atlantis Remixed to engage your students in additional educational content in the same way!



Mission Resources

This collection of resources may include background for teachers and students as well as additional activities that support or extend the learning of this chapter of the guide. None are required for completion of the mission. At the time of publication all URLs were current.

INTERNET LINKS

<http://marinelife.noaa.gov/>

Encyclopedia of the Sanctuaries

Examine photos, videos, and important biological information for thousands of marine species found in the thirteen U.S. national marine sanctuaries and the Papahānaumokuākea Marine National Monument.



Books and Literature

Who Really Killed Cock Robin?

George, Jean Craighead. *Who Really Killed Cock Robin?* Harper Trophy Books, 1992. In this eco-mystery about the death of a town's beloved mascot, the author tells the story of an intricate web of interrelationships and mutual interdependencies among plant life, animals, and humans. The 8th-grade detective uses a systems-thinking approach to solve the mystery.