

## Boiling River Research Guide **Answer Keys**

### Topic: Hydrothermal Systems of Yellowstone National Park

**Pre-Research Questions:** Read the article "[Hydrothermal Systems](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

Why was a water rights compact and controlled-groundwater area established by the National Park Service and the state of Montana?

A water rights compact and controlled-groundwater area was established by the National Park Service and the state of Montana to protect the "Known Geothermal Resources Areas" from development. In those areas, research on heat-resistant microbes is taking place.

What does the park's hydrothermal system need in order to exist?

The park's hydrothermal system needs the Yellowstone Volcano and water such as ground water from the mountains surrounding the Yellowstone Plateau to exist.

How is the superheated water (with temperatures exceeding 400°F) formed? Hint: It has to do with the water cycle and percolation.

Snow and rain slowly percolate through layers of permeable rock riddled with cracks. Some of this cold water meets hot brine directly heated by the shallow magma body. The water's temperature rises well above the boiling point, but the water remains in a liquid state due to the great pressure and weight of the overlying water. The result is superheated water with temperatures exceeding 400°F.

Describe the natural "plumbing" system of the park's hydrothermal features.

The superheated water is less dense than the colder, heavier water sinking around it. This creates convection currents that allow the lighter, more buoyant, superheated water to begin its journey back to the surface following the cracks and weak areas through rhyolitic lava flows.

What role does silica play in the park's "plumbing" system?

The silica precipitates in the cracks, increasing the system's ability to withstand the great pressure needed to produce a geyser. At the surface, silica precipitates to form siliceous sinter, creating the scalloped edges of hot springs and the seemingly barren landscape of hydrothermal basins. The siliceous sinter deposits, with bulbous or cauliflower-like surfaces, are known as geyserite.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

Hydrothermal Systems of Yellowstone National Park

2. Describe the 5 main hydrothermal features of Yellowstone National Park and how they work.

**Hot Springs:** Hot springs are springs of heated water. Yellowstone's hot springs are created when groundwater is heated by magma, and then emerges onto the surface.

**Geysers:** Geysers occur when groundwater is flowing down towards magma, which causes the water to be heated and pressurized, making water periodically spurt out of the ground. Geysers can erupt as occasionally as every few hours, or as often as every few minutes.

**Mudpots:** Mudpots are formed by standing surface water acidic enough to dissolve the surrounding rock into clay. Mudpots are areas that have high pH levels combined with low water conditions.

**Travertine Terraces:** Travertine is a type of limestone. It is deposited by mineral springs, such as Yellowstone's hot springs, and it often forms terraces when it flows down a hill.

**Fumaroles:** A fumarole is a vent from which gasses rise, mostly steam. This happens when water flows over hot rocks underground, and becomes so hot that it evaporates. The steam as well as other gasses rises to the surface where it escapes through a crack or hole in the surface.

3. How does Yellowstone's boiling river work?

In Yellowstone, the boiling river works by an underlying body of magma releasing tremendous heat along with using a variety of groundwater from the surrounding mountains in Yellowstone like rain or snow.

4. Why is Yellowstone's boiling river closed in spring and early summer?

It is closed due to its 400° temperatures that aren't suitable for most living breathing organisms compared to in the winter when the snow and rain can cool down the river making it more suitable for sustaining any sort of life.

5. What types of deaths/injuries have occurred as a result of Yellowstone's hydrothermal system? How frequent are deaths and injuries?

There have been around 52 deaths every 4,020,288 annual visitors, as well as an unknown number of injuries due to many other dangerous aspects.

6. What types of organisms can live in Yellowstone's boiling river? Can they cause any infections? Are there any invasive species?

Some species of bacteria live in the Yellowstone boiling river, these organisms are the amoeba Naegleria and the bacterium Legionella. They also live in 23 warm water spots in Yellowstone. The natural springs in Yellowstone contain many types of microorganisms that can lead to waterborne diseases like infection, skin rash, and gastrointestinal illnesses. There are many invasive species in Yellowstone such as Asian clams, Asian carps, Eurasian watermilfoil, hydrilla, flowering rush, and viral hemorrhagic septicemia.

7. One thing not included in this research guide that you would like to include on your page of the book.

Answers will vary.

### **Works Cited Page - What sources did you use to find the above information?**

Cite your sources **using MLA format**. Use [www.easybib.com](http://www.easybib.com) to help you! You need **at least 3** credible sources!

Answers will vary depending on which websites students use to research. Here are some commonly used sites:

1. <https://www.forbes.com/sites/michaelgoldstein/2021/02/02/americas-most-dangerous-national-parks/?sh=1eb1cdd81a23>
2. <https://www.nps.gov/yell/learn/nature/aquatic-invasive-species.htm#:~:text=The%20aquatic%20invasive%20species%20which,rush%2C%20and%20viral%20hemorrhagic%20septicemia>
3. <https://www.healthline.com/health/hot-potting#Are-hot-springs-safe>

## **Topic: Extremophiles**

**Pre-Research Questions:** Read the article "[Life in Extreme Heat](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

What are thermophiles?

Thermophiles are microscopic organisms can survive and thrive in extreme heat. Extremophile comes from “thermo” for heat and “phile” for lover.

How do thermophiles look? What conditions do thermophiles thrive in?

Thermophiles create colorful mats and streamers. They live in extreme heat, like hot springs.

What is an extremophile?

An extremophile is a microorganism living in extreme conditions such as heat and acid, that cannot survive without these conditions.

Describe the revised tree of life that microbial research led to.

The new tree combines animal, plant, and fungi in one branch. The other two branches consist solely of microorganisms, including an entire branch of microorganisms not known until the 1970s—the Archaea. Dr. Carl Woese first proposed this “tree” in the 1970s. He also proposed the new branch, Archaea, which includes many microorganisms formerly considered bacteria. The ancestor of the Bacteria, Archaea, and Eukarya is inferred to be where the blue, red, and green lines connect.

What are hyperthermophiles? Where do they fit into the revised tree of life?

Hyperthermophiles thrive in water above 176°F (80°C), indicating life may have arisen in hot environments on the young Earth.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

Extremophiles

2. Who is Rosa Vásquez Espinoza? Where does she go to school? What does she research?

Rosa Vásquez Espinoza is a Peruvian biochemist, National Geographic Explorer, and PhD candidate at the University of Michigan. She studies the microbes in the boiling river. Specifically, she studies the microbial and biochemical processes in plants, some used in the Elders’ medicines in the Amazon.

3. What types of organisms live in Peru’s boiling river? Why can’t the organisms that live in Peru’s boiling river be compared to those that live in the Yellowstone boiling river?

Different types of extremophiles like lichens, cyanobacteria, bacteria, and other microorganisms live in the boiling river since no animal can handle the boiling heat of 212°F. Yellowstone’s hot springs are highly acidic. The boiling river has a different geochemical profile, and the mineral composition is also constantly changing, which makes it so that the organisms in the two locations cannot be compared.

4. What is Rosa Vásquez Espinoza doing to better understand the unique ecosystem of the boiling river? How is she studying the microorganisms that live in the river? How does she hope this will contribute to medicine?

To better understand the unique ecosystem, Vásquez Espinoza is creating a map of the microbes living in the boiling river and seeing where they fit among other extremophiles from around the world. She is doing this by collecting samples from different places and soil in and near the river. She analyzes the sample by looking at the bacteria under a microscope. At the lab at the University of Michigan, Vásquez Espinoza plans to process the microbes and identify chemical compounds and proteins that have medicinal properties. The researchers can hijack the microbe’s machinery to pinpoint the specific proteins, and later replicate the machinery to make the proteins themselves. She is trying to better understand the role microbes play in creating natural products—and how their machinery might be later used to synthesize potential future medicines and therapeutics.

5. What did Andrés Ruzo do with the help of Spencer Wells and Jonathan Eisen?

Ruzo discovered new lifeforms - new species living inside the river. He also gathered data indicating the presence of a large hydrothermal system (the deeper into the earth, the hotter), but he still needs more research in order to discover the exact reason for its temperatures.

6. Can organisms who don't normally live in extreme temperatures and conditions adapt to live in the conditions of the boiling river?

Extremophiles are able to adapt to live in the extreme conditions of the boiling river.

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1. <https://explorer-directory.nationalgeographic.org/rosa-vasquez-espinoza>
2. <https://www.sciencefriday.com/articles/amazon-boiling-river-microbes/#:~:text=Deep%20in%20the%20Peruvian%20Amazon,in%20a%20sacred%20boiling%20river.>
3. <https://stmuscholars.org/the-river-that-can-cook-creatures-alive-perus-mysterious-boiling-river/comment-page-11/>

## **Topic: The Shaman, Culture, and Legends**

**Pre-Research Questions:** Read the article "[Shamans of Peru: Healing diseases with the power of the Earth](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

Explain the significance and meaning of Mayantuyacu.

Mayantu is a spirit from the jungle with the head of a frog and body of a lizard. The word "yacu" means water and the boiling river is home to many jungle spirits which only the powerful shamans can enter because the other people were afraid of them. Mayantuyacu is a community near the river.

Who is Maestro Juan?

Maestro Juan is the shaman and a Ashánika curandero, also known as a healer who runs the Mayantuyacu Healing Center. He is descended from a long line of healers (Ashánika curanderos).

What are shamans? What do they do?

Shamans are native doctors who have ancient knowledge of medicinal plants to heal the ill and protect the people. The shaman of Peru protects the boiling river and makes sure nothing disturbs it. The shamans also protect and guide the people around them.

How does someone become a shaman?

People are born into their role as a shaman; it is not a role to be chosen for. It's transmitted from generation to generation.

Describe the significance and role of shamans to the Peruvian people.

The shamans are wise people who are in touch with the link between the spirits and nature. It is to these shamans that the native communities owe, to a great extent, their survival. They also protect the boiling river for the people.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

The Shaman, Culture, and Legends

2. Describe the historical significance of the Spanish conquest of "El Dorado."

The Incas tricked some Spaniards who wanted to conquer the Inca and gain more gold by telling them to go to the Amazon where there was "El Dorado" (a lost city of gold). Only a few coming back, and they told stories of a boiling river.

3. What does Shanay-Timpishka translate to? What does this tell us about the indigenous people?

It translates to "boiled by the heat of the sun" It tells us that the indigenous people were wondering how the river worked and believed that the river was boiled due to the sun and not from underneath the surface of the Earth.

4. Explain the significance of "Yacumama." What does it mean? What does the legend say?

The legend of Yacumama, meaning "mother of water" is said to be a 60 meter serpent that releases hot and cold water into the river and is the mother of all creatures of the water.

5. Did the legend of "Yacumama" turn out to be true? Explain.

It is not yet proven that the Yacumama is real but everyone you talk to in the village either knows of someone who claims to see the Yacumama or who has seen it themselves. The legend persists and there are restaurants, hotels, places, and much more named after the serpent.

6. How did the shaman respond to Andrés' request to study the river? What was the shaman's condition?

Once Andres told the shaman of his intentions, he smiled, laughed and Andres got his blessing. The shaman's condition was that Andres was to pour the river back into the earth so that the water could find its way back "home" to the Amazon boiling river.

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Answers will vary depending on which websites students use to research. Here are some commonly used sites:

1. <https://www.livinginperu.com/terrifying-legends-peru-3-yacumama-sachamama/#:~:text=The%20True%20Story%3F,respectively%2C%20in%20the%20native%20language>
2. <https://www.nationalgeographic.com/adventure/article/160313-boiling-river-amazon-geothermal-science-conservation-ngbooktalk>
3. <https://medium.com/ted-takeaways/the-legend-of-the-boiling-river-ted-talk-more-by-andr%C3%A9s-ruzo-a-geoscientist-and-geophysicist-ee8a26a75977>
4. <https://www.forbes.com/sites/trevornace/2016/02/26/legendary-boiling-river-amazon-geological-anomaly/?sh=6f31767335cf>

## **Shamans of Peru: Healing diseases with the power of the Earth**

*Adapted from Jungle Experiences*

<https://www.jungleexperiences.com/blog/shamans-of-peru-healing-diseases-with-the-power-of-the-earth/>

## Topic: Andrés Ruzo

**Pre-Research Questions:** Read the article "[This River Kills Everything That Falls Into It](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

How did Ruzo first hear about the boiling river? What did he learn from his family?

Andrés Ruzo first heard about the boiling river when he was a child from his Peruvian grandfather who shared a legend about the Lost City of Gold in Peru. One of the details of the story was a 'river that boils.' His aunt has also been to the river before and talked about the shamans and its healing powers. She later guided him there.

What were the experts' thoughts on the idea of a boiling river? How did they react to Ruzo's questions about the river?

The experts did not believe the story and thought the river was impossible. They believed this because there was no volcanic activity within 700km.

What work was Ruzo doing that caused him to revisit the idea that the river could be real?

Ruzo was working on his PhD in geophysics when he finally decided to revisit the idea that the river could be real. He was looking at the heat of the earth, naturally hot springs, fumaroles, and volcanoes. One day, his colleagues from the Peruvian government called him to look at this map they were about to publish and he noticed there were some hot springs in the Amazon. He was determined to create the first detailed heat flow map of Peru so that he could identify areas of geothermal energy.

How did Ruzo get to the river?

Ruzo's first trip to the river was guided by his aunt. The boiling river is in the central of the Peruvian amazon. From Lima (where he is from), it is approximately an hour flight to the city of Pucallpa, the largest city in the central Peruvian Amazon. Then from Pucallpa, it was a two-hour drive to the Pachitea River. He then started hiking, and as he went deeper into the region, he started noticing vapor coming out from the trees. As he continued to walk, then there it was.

Describe the differences in temperature Ruzo initially observed.

He observed that the water was 86° Celsius, but when he took the peke-peke (motorized boat) with the shaman down the river, he noticed the water went from cold then to hot shower water temperature (36°C) as they sailed towards the mouth of the river.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

Andres Ruzo

2. Describe Ruzo's childhood. Where did he grow up? What did he do as a child?

Andrés Ruzo grew up in Nicaragua, Peru, and the United States. Spending summers on his family's farm near a volcano in Nicaragua, inspired him to study geology.

3. Where did Ruzo go to school? What did he study?

Ruzo went to Southern Methodist University where he studied Geology and Finance. He later began working on a PhD in Geophysics. A geophysicist is someone who studies Earth using electricity, gravity, magnetic, and seismic methods.

4. Ruzo is the Founder and Director of the Boiling River Project. What is the Boiling River Project?

The Boiling River Project is a U.S.-based nonprofit that has the ultimate goal of protecting the Boiling River of the Amazon, a site that's in a jungle considered open for development and disappearing rapidly. They are doing this through scientific research and educational initiatives.

5. How does Ruzo describe the significance of the boiling river? \*Revisit the TED Talk if you need help.\*

To the shaman and community, the river is a sacred site. To Ruzo and other geoscientists, it's a unique geothermal phenomenon. To the loggers and cattle farmers, it's a place full of resources to exploit. To the Peruvian government, it is more unprotected land to develop.

6. How is Ruzo trying to protect the river from development and deforestation?

Ruzo created the Boiling River Project, which is trying to stop deforestation and development around the river. Currently, members of this project are trying to close the geologic study chapter and are opening up the outreach component, the conversation efforts, to the public. They are also working to get the river declared a Peruvian National Monument.

7. One thing not included in this research guide that you would like to include on your page of the book.

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1. [https://www.ted.com/talks/andres\\_ruzo\\_the\\_boiling\\_river\\_of\\_the\\_amazon/transcript](https://www.ted.com/talks/andres_ruzo_the_boiling_river_of_the_amazon/transcript)
2. <https://www.npr.org/2016/03/18/470560004/could-a-boiling-river-from-a-childhood-legend-exist#:~:text=Andr%C3%A9s%20Ruzo%20grew%20up%20in,geophysics%20at%20Southern%20Methodist%20University.>
3. <https://explorer-directory.nationalgeographic.org/andres-a-ruzo>

## **Topic: Hypotheses for how the river works**

**Pre-Research Questions:** Read the article "[The Search for Peru's Boiling River](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

What 3 things do you need to create a large geothermal system?

1. A huge heat source
2. A large body of water
3. A 'plumbing system' that takes hot water from underground to the surface

Describe the 3 hypotheses for how the river works.

1. A volcanic feature
2. A non-volcanic feature
3. The result of an oil drilling accident

How did Ruzo rule out the first hypothesis?

Geochemical testing of the water indicated that it wasn't volcanic or magmatic.

How did Ruzo rule out the third hypothesis?

Ruzo ruled out the third hypothesis of an oil field accident because the river was around for years before the oil company came in. Additionally, the oil company that had operated near the area was transparent with their activities, which did not have an effect on the river.

What was Ruzo able to gather some data about?



the presence of a large, hydrothermal system

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

Hypotheses for how the boiling river works

2. What makes Peru's boiling river a geothermal phenomenon?

There are no volcanoes or significant heat sources in the area to heat the river. It is heated by fault fed hot springs - water seeps into the cracks of earth and heat up from deep within the earth.

3. How does a hydrothermal system work?

Water from the ocean goes down into the earth's core through cracks in the bottom and is heated by hot, molten rocks. The heated water rises back up to Earth's surface.

4. Describe the layers of Earth and how the temperature changes across layers. Include a diagram.

The layers of Earth are the crust, mantle, outer core, and inner core. The crust is the coolest and the inner core is the warmest. Temperature increases as you get closer to the core.

5. Calistoga's Old Faithful Geyser works because of a previous volcanic feature. Explain how the geyser works.

Geysers are made from a tube-like hole filled with water in Earth's surface that runs deep into the crust. Near the bottom of the tube is magma, which heats the water in the tube. The water begins to boil and as pressure builds some of the water is forced upward. The water eventually rushes through the tube and into the air. The eruption continues until all the water is forced out of the tube, or until the temperature inside the geyser drops below boiling (100 degrees Celsius, or 212 degrees Fahrenheit, at sea level). After the eruption, water seeps back into the tube and the process begins again.

6. Why are oil field accidents so serious? Provide examples.

Answers will vary: Oil field accidents can be fatal. Oil field workers are often exposed to heavy machinery, heights, chemicals, moving vehicles, and many other hazards. Examples of oil field accidents include:

- Defective or faulty equipment.
- Equipment malfunctions.
- Explosions.
- Exposure to toxic chemicals or materials.
- Fires.
- Oil rig set up or tear down.
- Slip and fall accidents.
- Struck by equipment or objects.

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1. <https://wonderopolis.org/wonder/where-is-the-boiling-river-of-the-amazon#:~:text=Ruzo's%20studies%20indicate%20that%20the,to%20near%20the%20boiling%20point>
2. <https://www.atlasobscura.com/places/the-boiling-river-of-the-amazon-puerto-inca-peru>
3. <https://www.nationalgeographic.com/adventure/article/160313-boiling-river-amazon-geothermal-science-conservation-ngbooktalk>
4. <https://www.geo-ocean.fr/en/Science-for-all/Our-classrooms/Hydrothermal-systems/Hydrothermalism/How-does-a-hydrothermal-system-work>

## Topic: How Does Peru's Boiling River Work?

**Pre-Research Questions:** Read the article "[The Search for Peru's Boiling River](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

Describe the 3 hypotheses for how the river works.

1. A volcanic feature
2. A non-volcanic feature
3. The result of an oil drilling accident

How did Ruzo rule out the first and third hypotheses?

Ruzo ruled out the first hypothesis of a volcanic feature through geochemical testing of the water, which indicated that it wasn't volcanic or magmatic. Ruzo ruled out the third hypothesis of an oil field accident because the river was around for years before the oil company came in. Additionally, the oil company that had operated near the area was transparent about their activities, which did not have an effect on the river.

What did Ruzo discover with the help of Dr. Spencer Wells and Dr. Jon Eisen?

First, they discovered new life forms and species that live in the river that can withstand the very hot temperatures. They also gathered data indicating the presence of a large hydrothermal system.

What did Richards hypothesize?

Richards hypothesized the river springs from multiple faults.

What is Ruzo's next step in research?

He needs to date the waters to find out how long they've been flowing underground.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

How does Peru's boiling river work?

2. Define and explain what Earth's geothermal gradient is.

The Earth's geothermal gradient is the increase in temperature per unit distance of depth. The closer to the center of the Earth, the hotter the temperature gets.

3. What does Ruzo know so far about how the boiling river works?

The water goes deep into the earth, heats up underground, and resurfaces through faults and cracks.

4. What is the average temperature of the river? What is the highest temperature that Ruzo measured? What does this mean for animals that fall in? What about people who touch the water?

The average temperature of the boiling river is 86°Celsius or 186° Fahrenheit. The highest temperature of the boiling river is around 200° Fahrenheit or 98° Celsius. Any animals that fall in will be cooked alive. Starting with the eyes and then from the inside out. If a person were to touch the water, they would get third-degree burns.

5. Where does the water come from? How can the water in the river potentially come from so far away?

The waters could be coming from as far away as glaciers in the Andes. The water would go into the earth and come out incredibly from the core. It can potentially come from so far away because of the faults in the ground

6. Provide a detailed explanation for how the river is heated.

The water goes down into the earth and then it heats up underground and goes up through cracks and faults and ends up in the river. It is boiling because the water that came up from cracks and faults is hot and pressurized.

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1. <https://www.telegraph.co.uk/travel/destinations/south-america/peru/articles/peru-mysterious-boiling-river-that-can-burn-you-to-death/>
2. <https://www.nationalgeographic.com/adventure/article/this-mythical-river-in-peru-is-boiling-and-one-young-scientist-is-on-a-quest-to-protect-it>
3. <https://www.nationalgeographic.com/adventure/article/160313-boiling-river-amazon-geothermal-science-conservation-ngbooktalk>

## **Topic: Tourism**

**Pre-Research Questions:** Read the article "[Visiting the Legendary Boiling River in Peru](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

How do the native Asháninka view the river? What do they use it for?

The Ashaninka view it as a sacred place. They use it in their daily lives for cooking, bathing, drinking, medicine, and conducting healing ceremonies.

How is deforestation affecting the river and its surroundings?

The area around the river is undergoing deforestation due to logging and other resource extraction. The part of the forest directly surrounding the river has not been greatly affected by deforestation. Deforestation nearby has probably driven more wildlife into the remaining forest. The ecosystem is still very much at risk; and the hope is that, with scientists and local citizens working together to protect the site, the rainforest surrounding this incredible natural wonder will remain intact for future generations to enjoy.

What does Mayantuyacu mean? What significance does it hold for the local people?

Mayantuyacu is a spiritual healing center and retreat for the locals. It is the oldest and most famous in the area. Mayantuyacu means "the water and the air." The water has healing properties, which is significant to the local people.

Who is Maestro Juan Flores? What practices do visitors engage in with him?

Maestro Juan Flores, the shaman of Mayantuyacu, is a member of the Asháninka tribe and descends from a long line of traditional curanderos (healers). Many visitors every year make the journey deep into the forest to Mayantuyacu to learn

about ancient healing techniques. These practices include drinking the potent hallucinogenic tea known as ayahuasca, as well as taking tobacco and other plant medicines.

How should the river be visited? Explain.

Visitors should go with a knowledge guide. The river is very dangerous and hot. If you don't know what you're doing, you can possibly get injured or cooked by the boiling river.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

Tourism

2. Can tourists swim in the river? Explain. (Can humans swim in the entire river? Will the river burn you if you swim in it? When is it best to swim in the river?)

It is possible to swim in the water BUT the river always starts off boiling and very, very hot. The only way to cool the river down is when it rains, and after the rain stops, the water is cool enough for you to swim in.

3. How can you get to the river? Make sure to include all modes of travel and estimated travel times.

First, you must fly to Peru and find a place to stay in the city of Pucallpa. You will be picked up at your hotel early in the morning to depart from the city of Pucallpa and start a two-hour road trip. You will next reach the dock from where you will embark on a 30-minute boat trip on the Pachitea River. After this, you will hike for one and a half more hours. At the end of this trek, you will reach the spot of the boiling river where the water temperature exceeds 90°C (194°F). For a group of two people, not including airfare, this costs \$370 per person.

4. Can you get hurt visiting the river? How common are accidents? How far is the nearest hospital?

Yes, you can get 2<sup>nd</sup> or 3<sup>rd</sup> degree burns from the water. However, many people have gone to the river with no incident. The nearest hospital is roughly 3 hours away from the boiling river.

5. Why did being bilingual allow Andrés Ruzo to study the river?

He was able to get permission from the Shaman to study the river and bring back information about it. Being bilingual also allowed Ruzo to talk to the natives and learn more about the boiling river.

6. Research how to schedule a Boiling River tour and explain how someone can visit the river.

Answers will vary: You can schedule a Boiling River tour on <https://www.denomades.com/en/pucallpa/boiling-river-mayantuyacu-id871>. You can visit the river by going to Peru and following a tour guide to get there.

7. One thing not included in this research guide that you would like to include on your page of the book.

Answers will vary.

### **Works Cited Page - What sources did you use to find the above information?**

Cite your sources **using MLA format**. Use [www.easybib.com](http://www.easybib.com) to help you! You need **at least 3** credible sources!

Answers will vary depending on which websites students use to research. Here are some commonly used sites:

1. <https://www.cusconative.com/boiling-river-in-peru/>
2. <https://www.denomades.com/en/pucallpa/boiling-river-mayantuyacu-id871>
3. <https://www.atlasobscura.com/places/the-boiling-river-of-the-amazon-puerto-inca-peru>

## Topic: Conservation

**Pre-Research Questions:** Read the article "[A Legendary Boiling River Flows Through the Amazon. Can It Be Saved?](#)" and answer the following questions with several sentences in YOUR OWN WORDS.

Explain the following quote: "The greatest threat to the jungle are the 'natives' who have forgotten they are natives."

This quote means: the people who hurt the jungle the most are the people who forgot about the land itself and what's on it. They see it as a resource to exploit. The narrative that tends to be pushed is that businesses and corporations are bad and encourage exploitation of the land, and the native people are good and fight to preserve the wildlife. However, it's not that simple. Often, the native people forget the value of the place they live and instead look to how they can profit from it.

How have some oil and gas companies been helpful in protecting the river?

The oil and gas companies protect the river because they are required to put up signs, even on Google Maps, that the jungle area is now protected by the oil and gas companies. If they don't do this, they will get fined for not cooperating with environmental regulations and even lose their concession.

What is causing 99% of the deforestation?

99% of the deforestation is caused by locals who cut down and burn the trees. They then set cattle loose on the land.

Why is the goal to have the area declared a Peruvian national monument?

Currently, the jungle is legally considered exploitable jungle, so it is basically open to clear-cutting. Declaring it a Peruvian national monument will help get it rezoned so that it's only open for eco-friendly activities.

What is so special about the boiling river?

Some special features of the boiling river are the traditions and culture that surrounds it. Another feature would be how interesting its geological factors are and how the river draws many people in just to get a peek at it. In addition to the culture and geological factors, the river is home to lots of unique plants and animals that can't be found anywhere else in the Amazon now.

**Research Questions:** Use the internet to answer the following questions. Cite your sources in MLA format.

1. What topic is your group researching?

Conservation

2. What is deforestation? Describe the positive and negative impacts it can bring.

Deforestation is the intentional clearing of land by humans for animal grazing, agriculture, and wood. It can have good impacts: more space to grow crops or timber for construction. It also comes with an array of negative effects: a decrease in biodiversity (forests are homes to many different animals and plants that cannot survive in other conditions) and carbon dioxide being released into the air (contributing to climate change)

3. What impacts does deforestation have on the river and locals?

- Bad water quality (lots of erosion, pesticides, cattle contamination)
- Soil falling apart
- Plants and animals not having safe homes

4. How does Rosa Vásquez Espinoza's work on the boiling river support the protection of the river and its diverse ecosystem?

Rosa Vásquez Espinoza is working to research the microbes that live in the boiling river. With their incredible ability to survive at such high temperatures these microbes could potentially hold cures to all sorts of diseases - even cancer. This possibility makes the boiling river valuable and worth protecting in order to have a chance at helping human life.

5. What is the aim of the Boiling River Project?

The Boiling River Project (nonprofit) works to protect the boiling river and increase awareness of its significance. One of the nonprofit's goals is to make the boiling river a Peruvian national monument, which would make the site only available for tourism and ecological research.

6. Provide a local example of deforestation. Explain the impacts it has on the environment.

Answers will vary based on location.

7. One thing not included in this research guide that you would like to include on your page of the book.

Answers will vary.

### **Works Cited Page - What sources did you use to find the above information?**

Cite your sources **using MLA format**. Use [www.easybib.com](http://www.easybib.com) to help you! You need **at least 3** credible sources!

Answers will vary depending on which websites students use to research. Here are some commonly used sites:

1. <https://www.nationalgeographic.com/adventure/article/this-mythical-river-in-peru-is-boiling-and-one-young-scientist-is-on-a-quest-to-protect-it>
2. <https://education.nationalgeographic.org/resource/deforestation>
3. <https://www.sciencefriday.com/articles/amazon-boiling-river-microbes/>