



COMMUNICATING RESEARCH

How research conducted in Yellowstone National Park communicated to others.

Research in Yellowstone

Year round researchers visit Yellowstone to study everything from the ecosystem to geology to the how microorganisms might show how life could exist on other planets.

158 YEARS

Starting as letters and journal entries, there is a long standing history of study with in Yellowstone National Park.

150

research projects take place in Yellowstone each year.

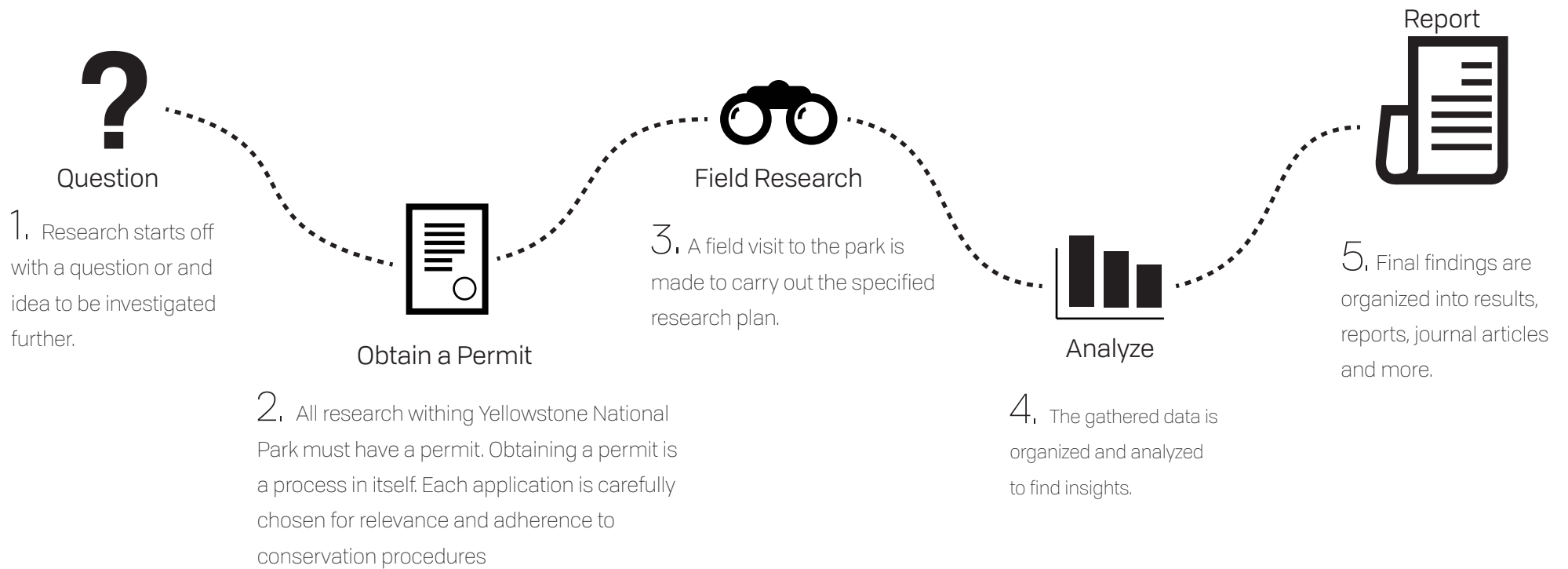


Researchers come from all over the globe to study the park and everything in it.

“Many of these scientific studies have ramifications far beyond Yellowstone National Park.”

National Park Service

Research Process



Research happens here. **But does anyone notice?**

Millions of people walk by the sites where vital park research is taking place without ever being aware that it is going on and of what importance it might be.



Research helps us understand the world around us and our place in it



Research determines how we interact with the park.

In recent years numbers of visitors to Yellowstone National Park have dramatically increased to over 4 million per year. These numbers are urging research into how we might better interact with the over-taxed infrastructure of the park.

Research determines what survives and dies.

In 1995, wolves were re-introduced to Yellowstone changing the ecosystem drastically. Some species numbers began to be reduced while others flourished.

Research determines the **FUTURE.**



Yellowstone is a national treasure to many of us, to some it could be seen as a geo-thermal gold mine that could be exploited to profit from the land. Research will be key to how we make decisions about public lands in the future.

Research can be....

COMPELLING
FUN

EMOTIONAL

CHALLENGING

EXCITING

INSIGHTFUL

SURPRISING

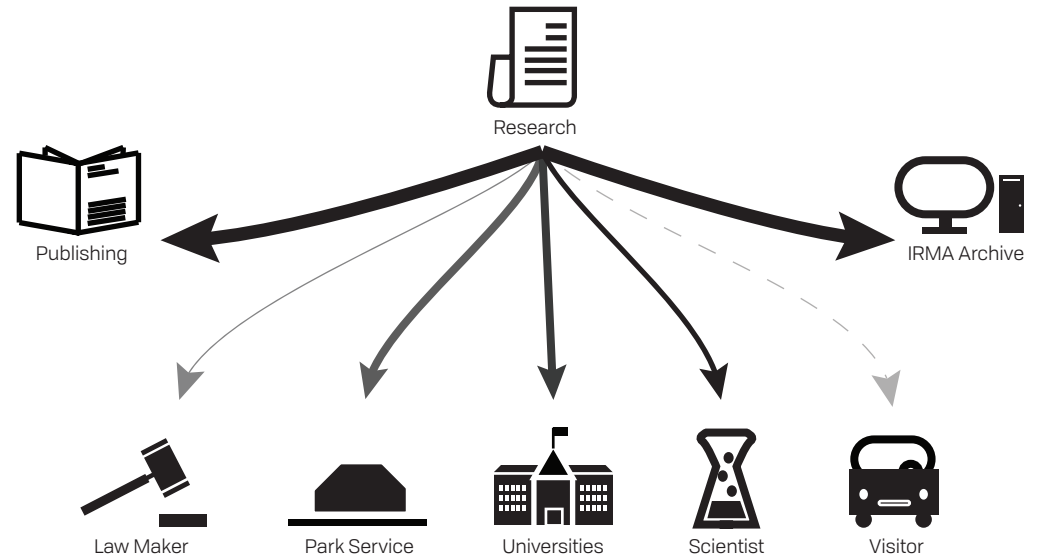
LIFE CHANGING

CRUCIAL

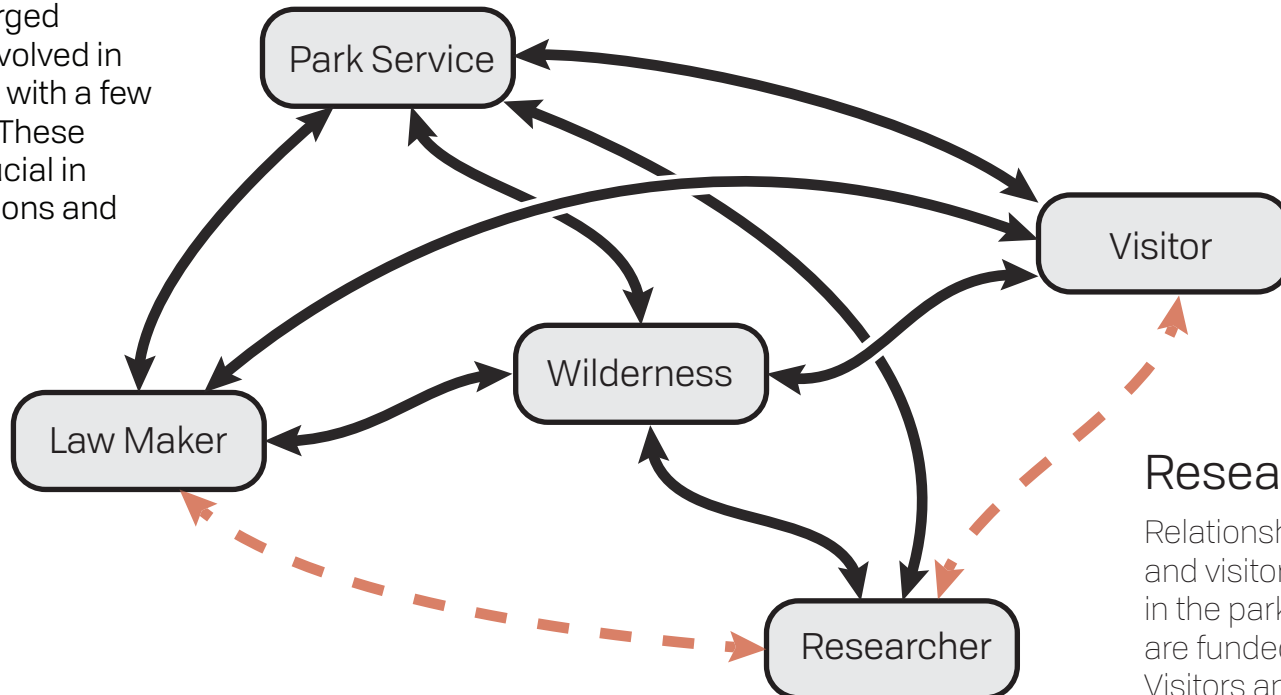
but sometimes comes
across as....

INVESTIGATOR'S ANNUAL REPORT			
United States Department of the Interior National Park Service		OMB # 1024-0046 Exp. Date 12/31/2020 Form No. 1042-2	
All or some of the information you provide may become available to the public.			
Reporting Year: 2017	Park: Yellowstone	Select the type of permit this report addresses: Scientific Study	
Principal Investigator: Dr. Matt Pasternak	Office Phone: 303.816.2482		
Mailing Address: Ecology Branch NASA Ames Research Center 349 219-A Moffett Field, CA 94035	Office Fax: 650.604.1083		
Office Email: aposternm@gmail.com			
Additional investigator or key field assistant (first name, last name, office phone, office email)			
Name: Jack D. Farmer	Phone: 405.965.6748	Email: jfarmer@ron.edu	
Name: Brian L. Beard	Phone: 602.242.1806	Email: beardb@geology.wisc.edu	
Name: Linda L. Jalala	Phone: 605.604.3221	Email: Linda.L.Jalala@nps.gov	
Name: Mary M. Pasternak	Phone: 303.816.2482	Email: mary.pasternak@nasa.gov aposternm@gmail.com	
Name: Vikki Meadows	Phone: 206.543.0006	Email: vmm@nps.washington.edu	
Name: Charles Teleco	Phone: 352.284.1874	Email: teleco@nps-nl.edu	
Name: William Sparks	Phone: 410.333-6843	Email: wspark@usnc.edu	
Name: Lydia Krueger	Phone:	Email: lydia.krueger@gmail.com	
Study Title (maximum 300 characters): Geomicrobiology and Biogeochemistry of Phototrophs in High-Boon Thermal Springs			
Park-assigned Study or Activity #: YELL-01549	Park-assigned Permit #: YELL-2017-SCS1549	Permit Start Date: Jan 01, 2017	Permit Expiration Date: Dec 31, 2017
Scientific Study Starting Date: Nov 03, 2016	Estimated Scientific Study Ending Date: Jan 01, 2020		
For either a Scientific Study or a Science Education Activity, the status is: Continuing	For a Scientific Study that is completed, please check each of the following that applies: <input type="checkbox"/> A final report has been provided to the park or will be provided to the park within the next two years. <input type="checkbox"/> Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park. <input type="checkbox"/> All collected and prepared specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed.		
Activity Type: Research			
Subject Discipline: Microbi			
Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters): We are seeking to understand the effects of microorganisms and their phototrophic activity on iron and manganese oxidation and mineralization processes in hot spring microbial mats. Specifically, we have hypothesized that cyanobacteria species Fe(II) or Mn(II) is a type of anoxygenic phototroph known as phototrophy or photomanganese, respectively. Pearson and Olson (2008)			
The National Park Service uses an e-mail or website, and a permit is not required in regard to the collection of information unless it displays a readily visible OMB control number (applicable to this version 10-11-2014). Page 1 of 2			

Research is disseminated and used to form relationships



Relationships are forged between all those involved in and around the park with a few notable exceptions. These relationships are crucial in order to make decisions and protect the park.



Researcher ↔ Visitor

Relationship between researchers and visitors and not allowed to exist in the park. Many research projects are funded from tax dollars paid by Visitors and the general public.



It all ends up somewhere...


The national Park service and Yellowstone National Park house multiple archives and collections with documents, artifacts, oral histories, maps, and photographs dating back to the first days of the park. Included in these are surveys and research documents for all official research that takes place in Yellowstone.

IRMA -The Integrated Resource Management Application is a digital archive of each research study taking place in all if the national parks. IRMA also includes current surveys, species information, and parks planning data.



OPPORTUNITY

With over 150 research projects taking place in Yellowstone National Park, current research, though available to anyone, can be difficult to find and understand. There is an opportunity for research to reach broader audiences, forging connections and leading to change.



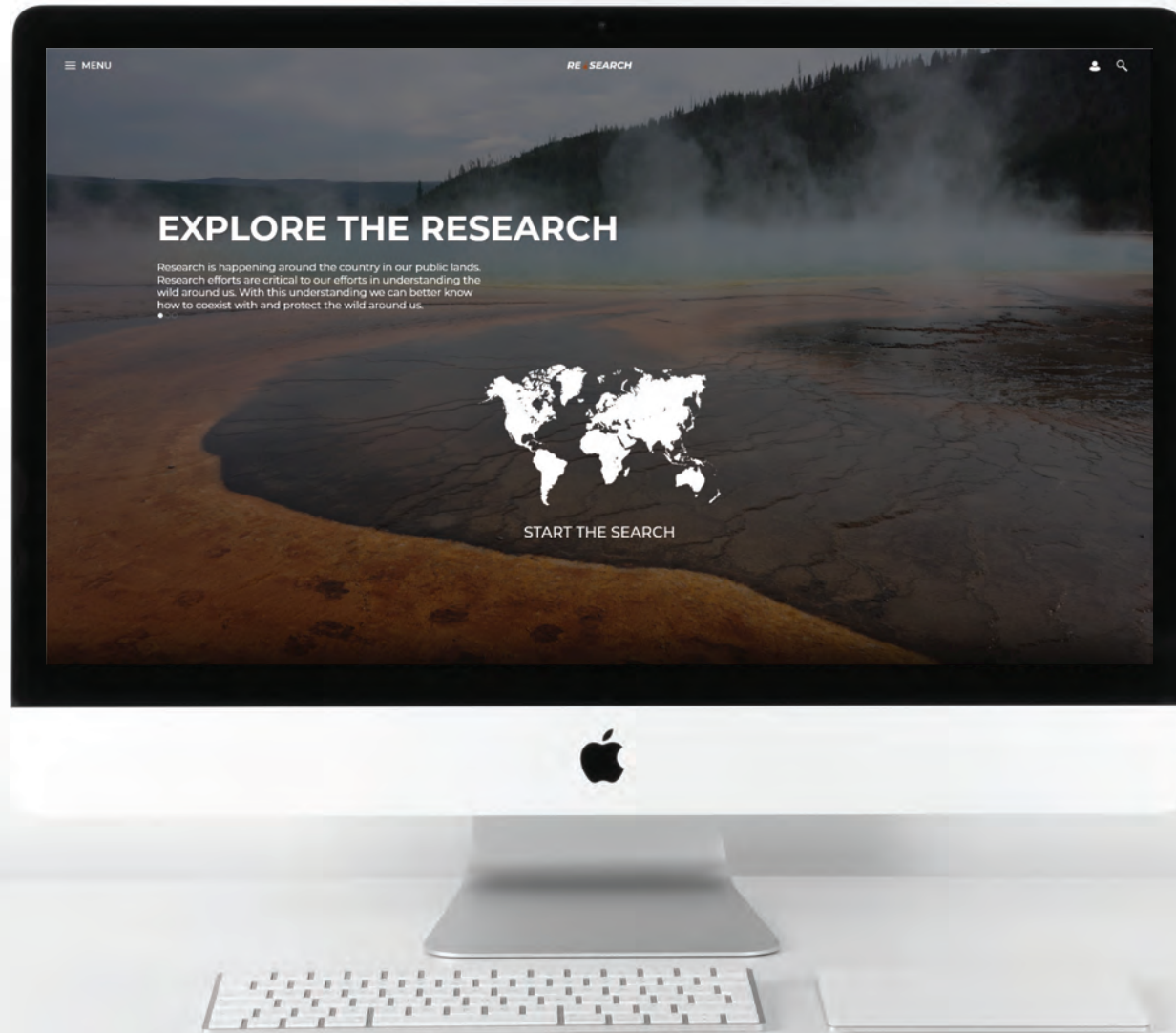
“...scientists have a responsibility to explain what they do to others, particularly the taxpaying public, in ways that are both clear and compelling.”

RE SEARCH

The digital platform to help public land visitors locate and engage with research

- Experience Where Research Happens
- Find Research Sites
- Dive into a Research Topic
- Adventure and Make a Field Visit
- Take Learning with you in the Mobile App
- Return and Continue Learning with Study Updates

Locate and Engage it with **RE**  **SEARCH**

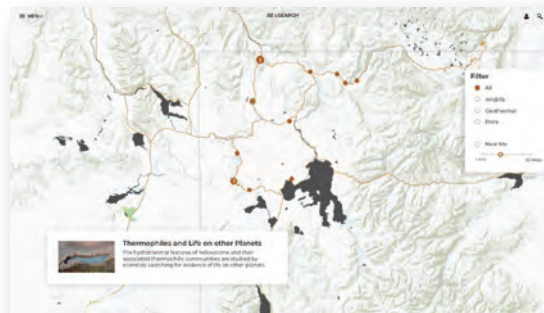




Locate and Plan



Search by Location



Filter and Select



Search by Topic



Visit and Explore



Directions to Site



Find Close Research



Learn on Site



Mark for Later Learning



Learn



Researcher Curated Learning



Study Specific Information



Continue Learning with External Links

Research Study Page

Topic Overview

Thermophiles



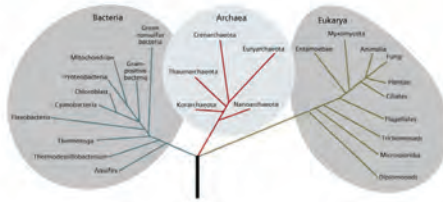
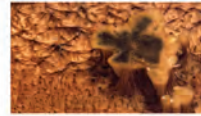
The hydrothermal features of Yellowstone are significant evidence of Earth's volcanic activity. Amazingly, they are also habitats in which microscopic organisms called thermophiles—"thermo" for heat, "phile" for love—survive and thrive.

Grand Prismatic Spring at Midway Geysers Basin is an outstanding example of this dual characteristic. Visitors marvel at its size and brilliant colors. Along the boardwalk, we cross a vast habitat for thermophiles. Nourished by energy and chemical building blocks available in the hot springs, microbes construct vividly colored communities. Living with these microscopic life forms are larger examples of life in extreme environments, such as mines, fires, sanders, and plants.

Communities

Thermophilic communities are as diverse as the communities that humans live in. Community formations, colors, and locations vary depending on the types of microbes, the pH, and the temperature of their environments. Here, we discuss the microbial communities most easily seen in Yellowstone.

Millions of individual microbes can connect into long strands called filaments. Some bacteria and algae form thin and delicate structures in fast moving water such as the sulfid channels of hot springs and geysers. Other microbes form thick, sturdy structures in slower water or where chemical precipitates quickly coat their filaments.



Meet The Researcher



Jason Baker
Education: B.S. Microbiology, University of Utah, 2003
Secondary Science Teaching Degree, University of Utah, 2005

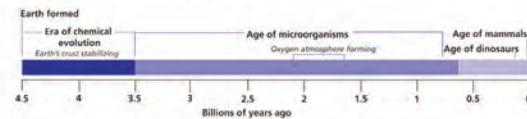
I started with a love for the outdoors and was always fascinated with how life always found a way to thrive within their own kingdoms. In college I had the opportunity to do some research in Yellowstone where I was introduced to thermophiles, and their amazing ecosystems. As I learn more and more I have a desire to teach others and help them share the passion I feel.

I have a degree in Microbiology from the University of Utah where I was not far from Yellowstone and was able to make regular field visits to the park for research. As we look into new facets of the ecosystem we will be sending pieces of our findings here for you to continue your own exploration and learning.

Life on other Planets

The hydrothermal features of Yellowstone and their associated thermophilic communities are studied by scientists searching for evidence of life on other planets. The connection is extreme environments. If life began in the extreme conditions thought to have been widespread on ancient Earth, it may well have developed on other planets—and might still exist today.

The chemosynthetic microbes that thrive in some of Yellowstone's hot springs do so by metabolizing inorganic chemicals, a source of energy that does not require sunlight. Such chemical energy sources provide the most likely habitable niches for life on Mars or on the moons of Jupiter—Ganymede, Europa, and Callisto—where uninhabitable surface conditions preclude photosynthesis. Chemical energy sources, along with extensive groundwater systems, both in on Mars or oceanic hydrothermal vents (such as on Jupiter's moon) could provide habitats for life.



Connect to the research team

Why is this study important to the topic?

Deep-Dive External Learning Links

Pinpoint Research Locations

Related & Nearby Studies

Keep up to date with the researchers

Where will **RESEARCH** take you next?



Project by Jordan Rasmussen

Sources:

<https://www.yellowstone.org/news/media/>

<https://www.nps.gov/yell/learn/management/researchpermit.htm>

<https://www.nps.gov/yell/learn/nature/historyscience.htm>

<https://www.chronicle.com/article/Making-Science-Understandable/45661> Richard Ries 1999

WWW.NPS.GOV

<https://www.nps.gov/yell/learn/nature/historyscience.htm>

Photo Credit

Photo of boy Credit: YF/Jess Haas

Photo class in snow Credit: YF/Maria Bisso

Research photo Credit: Washington State University

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