# Thermophile Ecology Basic Lesson Plan

Title**: T**hermophile Safari

Grades: 7th-12th

Length**:** 1 to 1.5 hours

Topic**:** Thermophile Ecology in Hot Springs National Park

Summary:

Thermophiles, organisms that survive in extreme heat conditions, are one of the most unique resources found in Hot Springs National Park. Using scientific studies and on-site observations, students will assess the factors that have made Hot Springs’ thermophilic ecosystem a site of particular interest for NASA field studies. Students will then identify the adaptive features of specific thermophiles, and determine where they are likely to be found in the thermal spring system. Finally, students will use the dispersal patterns of thermophilic communities to hypothesize how the presence of thermophiles offers clues about the variety of thermophilic environments found in the park.

## Arkansas State Standards:

### 6th Grade

*6-LS1-1*: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

*6-LS1-5*: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

### 7th Grade

*7-LS1-6*: Construct a scientific explanation based on evidence for the role of photosynthesis in the *cycling of matter and flow of energy into and out of organisms.*

*7-LS1-7*: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

*7-LS2-3*: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

*7-LS2-4*: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

### High School Biology

*BI-LS2-6:* Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

*BI-LS2-7:* Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

*BI-LS4-5:* Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

*BI-ESS2-5*: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

## Essential Question:

What are the characteristics of Hot Springs thermal ecosystems that make them different from most other known thermal ecosystems?

## Enduring Understanding:

A variety of factors—isolation, heating process, geological setting, and human impact—make Hot Springs National Park one of the most unique thermal water ecosystems in the United States.

## Objectives

1. Students will be able to use maps and geological profiles to identify unique characteristics of the Hot Springs setting.
2. Students will be able to identify at least one type of thermophile that resides in Hot Springs.
3. Students will be able to use thermal data and energy production understanding to determine what types of springs a thermophile is most likely to be found in.
4. Students will be able to use scientific research to locate where specific thermophiles are found in the park and hypothesize why they might survive there.