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VEGETATION OF WYOMING  
THERMAL SPRINGS OUTSIDE OF  
YELLOWSTONE NATIONAL PARK

by

Terry T. Terrell



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# VEGETATION OF WYOMING THERMAL SPRINGS OUTSIDE OF YELLOWSTONE NATIONAL PARK

by  
Terry T. Terrell\*

## Introduction

One of the most striking features of warm springs is the great variety and array of colors present. While some of these colors are due to mineral deposits, most result from aggregations of huge numbers of brightly colored microorganisms. These microorganisms range in color from white through reds, oranges, yellows, browns and purples, to deep greens and blue-greens. There are four main groups represented in most warm springs, the Bacteria (Schizophyta), Blue-green Algae (Cyanophyta), Green Algae (Chlorophyta) and Diatoms (Bacillariophyta). Occasionally, the Yellow-green Algae (Xanthophyta) occur peripherally to the hot springs in areas where the water temperature is near ambient. Seldom are they important components of hot springs systems. Each group has its characteristic colors and textures, so that the four main groups can be distinguished visually with a little practice.

## Bacteria, Schizophyta

The bacteria are very primitive and simple one-celled organisms which lack a nucleus. Because of this simplicity, they can withstand higher temperatures than can members of the other groups, and some can live in boiling water (212° F, 100°). Bacteria growing at such high temperatures are highly adapted to this type of environment and cannot survive in cooler areas. Although the bacteria are microscopic, they aggregate in large numbers and have such characteristic colors and textures that they are easily identifiable with the naked eye. There are three main types—those that occur in long white streamers, those that occur in yellowish or whitish clumps, and those that are very bright pink-purple clumps or layers. While none of these bacteria photosynthesize (use the sun's energy for food production), the last two types, those occurring in whitish or yellowish clumps and those in pink-purple clumps or layers, can use sulfur available in many hot springs in their process of food production.

## Blue-green Algae, Cyanophyta

The blue-green algae are a very old and primitive group. There is good fossil evidence that they were the first photosynthetic organisms to evolve on earth, and that they came into being over a billion years ago. While the blue-green algae are primitive in the sense that they lack a nucleus, they have developed photosynthetic pigments which give them very characteristic colors. As the name suggests, all members of the group have a blue pigment, phycocyanin, and a green pigment, chlorophyll (all photosynthetic organisms contain the green chlorophyll pigment). Many appear blue-green to the naked eye. Some are so dark blue-green that they appear black. Other pigments are present, too. These include phycoerythrin, a red pigment, and various carotenoids which are shades of yellow, brown and orange. When the conditions are right, these other pigments may combine with or mask the blue and green pigments to give a striking array of colors. Blue-green algae may appear

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red, reddish-brown, tan, olive green, orange, yellowish, or purplish as well as blue, blue-green, or black.

The group also has a distinctive array of textures which may help to distinguish it from the others. Members of the group may appear as a mass of fine filaments or threads intertwined, as a solid sheet or mass resembling rubber, or as very coarse filaments.

If you wish to be certain you are looking at a blue-green alga, there is an excellent way to determine this. Take a small portion home, wash it carefully and place it in a plastic bag with a small amount of water in your home freezer. Remove the plastic bag from your freezer after a few days and allow it to thaw. If the water turns blue, the alga you collected was a blue-green, and you have just extracted its blue or phycocyanin pigments.

Blue-green algae are the most common and obvious inhabitants of warm springs. Some may only grow in the very warmest portions of the spring and be unable to survive at more moderate temperatures. Others can tolerate fairly high temperatures but grow best in cooler portions of the spring. In most hot springs, most of the vegetation is usually blue-green algae.

### Green Algae, Chlorophyta

The green algae are unicellular, have a nucleus, and are very similar to higher plants in many respects. They are not inhabitants of the hottest portions of hot springs, but are very abundant in the cooler portions. These cooler portions of hot springs approximate the temperatures and conditions found in small ponds and lakes in the summer all over the world, and thus the inhabitants are similar to those found in such habitats. The character of hot springs, with their warm and fairly constant temperatures, allows these microscopic inhabitants to live in constant summer temperatures, and to reproduce in large numbers. They may remain unicellular or form in long chains or filaments and these filaments may become tangled into mats. Their chief pigment is the green chlorophyll and they are easily recognized by their bright grass green color.

### Diatoms, Bacillariophyta

The diatoms are an extremely interesting group. Besides having a nucleus and chlorophyll, as well as some of the yellow, orange and brown carotenoid pigments, they have the unique ability to construct cell walls out of silicon, the same material used in making window glass. They are similar to the green algae in the sense that they are not true inhabitants of the hottest parts of hot springs. They also take advantage of the summerlike conditions of the cooler parts. They never grow in the great profusion witnessed among the other groups, and will be found as fine, felt-like, brownish-yellowish-green masses on rocks and twigs in warm springs.

### List of Genera of Algae and Types of Bacteria Found in Hot Springs in Wyoming, Outside of Yellowstone National Park

Following is a list of the genera of algae and types of bacteria found in the various hot springs in the State of Wyoming, outside of Yellowstone National Park. Smith's *Freshwater Algae of the United States* is an excellent source of line drawings of the genera, and Copeland's "Yellowstone Thermal Myxophyceae" an excellent source of descriptions of species of Cyanophyta which occur in hot springs, if you wish to go into much greater detail. For the general reader, *Life in the Geyser Basins* by Brock and Brock is a well written, simple description of the hot springs of Yellowstone National Park, and has several attractive color photographs.

HOT SPRING	GROUP	GENERA
Abercrombie Warm Springs (Teton)*	Chlorophyta	<i>Cladophora</i>
Astoria Springs (Teton)	Schizophyta Cyanophyta	? <i>Lyngbya</i> <i>Phormidium</i>
Auburn Hot Springs (Lincoln)	Schizophyta Cyanophyta	Purple Sulfur Bacteria <i>Lyngbya</i> <i>Oscillatoria</i> <i>Spirulina</i> <i>Phormidium</i>
	Chlorophyta Bacillariophyta	<i>Ulothrix</i> <i>Denticula</i> <i>Rhopalodia</i> <i>Cymatopleura</i> <i>Anomoeoneis</i> <i>Navicula</i> <i>Gomphonema</i>
Big Fall Creek Springs (Sublette)	Bryophyta (Moss)	?
Big Spring, Thermopolis (Hot Springs)	Schizophyta Cyanophyta	? <i>Phormidium</i> <i>Mastigocladus</i>
Boyles Hill Springs (Teton)	Schizophyta Cyanophyta	Purple Sulfur Bacteria <i>Lyngbya</i> <i>Phormidium</i> <i>Synechocystis</i>
Conant Creek Springs (Fremont)	Cyanophyta	<i>Oscillatoria</i> <i>Spirulina</i>
De Maris Hot Springs (Park)	Schizophyta Cyanophyta	? <i>Oscillatoria</i> <i>Lyngbya</i>
	Chlorophyta Bacillariophyta	<i>Spirogyra</i> <i>Cymbella</i> <i>Gomphonema</i>
Douglas Warm Spring (Converse)	Cyanophyta	<i>Oscillatoria</i> <i>Synechocystis</i>
Granite Falls Hot Springs (Teton)	Schizophyta	Purple Sulfur Bacteria ?
	Cyanophyta Bacillariophyta	<i>Oscillatoria</i> ?
Granite Hot Springs (Teton)	—	—
Immigrants Washtub (Platte)	Cyanophyta	<i>Lyngbya</i> <i>Oscillatoria</i>
	Chlorophyta Xanthophyta Bacillariophyta	<i>Cladophora</i> <i>Tribonema</i> <i>Navicula</i> <i>Cymbella</i> <i>Diatoma</i>

\*The county in which it occurs follows each hot spring name.

HOT SPRING	GROUP	GENERA
Hobo Pool, Saratoga Hot Springs (Carbon)	Cyanophyta	<i>Spirulina</i> <i>Phormidium</i> <i>Chroococcus</i> <i>Oscillatoria</i> <i>Rivularia</i> ?
	Bacillariophyta	<i>Ceratoneis</i> <i>Cymbella</i>
Horse Creek Spring #1 (Natrona)	Cyanophyta	<i>Phormidium</i> <i>Spirulina</i> <i>Oscillatoria</i>
	Chlorophyta	<i>Spirogyra</i> <i>Microspora</i>
	Bacillariophyta	<i>Navicula</i>
Horse Creek Spring #2 (Natrona)	Chlorophyta	<i>Microspora</i> <i>Spirogyra</i>
	Xanthophyta	<i>Vaucheria</i>
	Bacillariophyta	<i>Rhopalodia</i> <i>Gomphonema</i>
		<i>Navicula</i>
Horse Creek Spring #3 (Natrona)	Chlorophyta	<i>Dichotomosiphon</i> <i>Ankistrodesmus</i>
	Cyanophyta	<i>Anabaena</i> <i>Oscillatoria</i> <i>Phormidium</i> <i>Spirulina</i>
Huckleberry Hot Springs (Teton)	Bacillariophyta	<i>Navicula</i> <i>Pinnularia</i> <i>Surirella</i> <i>Rhopalodia</i> <i>Denticula</i> <i>Epithemia</i> <i>Campylodiscus</i>
	Chlorophyta	<i>Rhizoclonium</i>
Kelly Warm Spring (Teton)	Bacillariophyta	<i>Amphora</i> <i>Gomphonema</i> <i>Nitzschia</i>
	Cyanophyta	<i>Oscillatoria</i>
Kendall Warm Springs (Teton)	Chlorophyta	<i>Spirogyra</i>
	Bacillariophyta	<i>Epithemia</i>
		—
Little Sheep Mountain Spring (Big Horn)	Chlorophyta	<i>Spirogyra</i>
	Bacillariophyta	<i>Stauroneis</i> <i>Melosira</i> <i>Frustulia</i> <i>Navicula</i> <i>Pinnularia</i> <i>Gyrosigma</i> <i>Surirella</i>
		—
		—
		—
		—
		—
Little Warm Spring (Fremont)	—	—

HOT SPRING	GROUP	GENERA
Sacajawea Well, Thermopolis (Hot Springs)	Schizophyta	?
	Cyanophyta	<i>Phormidium</i>
Sheep Mountain Springs (Big Horn)	Cyanophyta	<i>Oscillatoria</i>
		<i>Tolypothrix</i>
		<i>Scytonema</i>
		<i>Merismopedia</i> ?
	Bacillariophyta	<i>Epithemia</i>
		<i>Pinnularia</i>
		<i>Nitzschia</i>
		<i>Meridion</i>
		<i>Rhopaloida</i>
		<i>Cymbella</i>
	<i>Navicula</i>	
	<i>Gomphonema</i>	
Sweetwater Station Springs (Fremont)	Cyanophyta	<i>Oscillatoria</i>
		<i>Phormidium</i>
Teton Valley Warm Springs (Teton)	Chlorophyta	<i>Spirogyra</i>
		<i>Rhizoclonium</i>
Teton Valley Warm Springs (Teton)	Bacillariophyta	<i>Gomphonema</i>
		<i>Synedra</i>
		<i>Amphora</i>
Warm Spring Creek Springs (Fremont)	—	—
White Sulphur Spring, Thermopolis (Hot Springs)	Schizophyta	?
	Cyanophyta	<i>Phormidium</i>
	Chlorophyta	<i>Spirogyra</i>
Wind River Canyon Spring (Hot Springs)	Cyanophyta	<i>Oscillatoria</i>
		<i>Spirogyra</i>
	Chlorophyta	<i>Zygnema</i>
		<i>Microspora</i>
	Xanthophyta	<i>Vaucheria</i>
	Bacillariophyta	<i>Cocconeis</i>
		<i>Navicula</i>
		<i>Synedra</i>

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