Yellowstone Science

A quarterly publication devoted to the natural and cultural resources

Preserving Yellowstone's Natural Conditions Reviewed

Cultural Resources Management

Christmas Bird Counts

Fungus Among Us

Time Machine

Volume 9 Number 1

Reflections on a 50-Year Relationship…

In the eight years of its existence, *Yellowstone Science* has reported on a wide variety of topics related to natural wonders and cultural history. This first issue of the twenty-first century continues to address the general theme of constant change in the natural world. Our thanks to authors for their voluntary contributions that help all of us to better understand the workings and history of this special place.

Beyond its natural and cultural resources, let me here suggest that this park has another noteworthy resource. It's something you have to work here to know about. For the 50 years that I have personally enjoyed an on-and-off working relationship with this park's staff—first as a seasonal ranger in the early 1950s and in recent winters as a volunteer wildlife biologist—I've found that there has always been a small central core of individuals who cheerfully do the bulk of the daily business of preserving, protecting, and helping others to enjoy.

My salute to those individuals whose love of Yellowstone is expressed by dedication to their work, no matter how menial the task. Some of these devoted individuals are found in the production staff of this publication. I thank them for making my brief stint as guest editor both easy and pleasurable. May this park always have the benefit of a dedicated core of hard-working people. Truly, they are another special resource.

Jim Caslick

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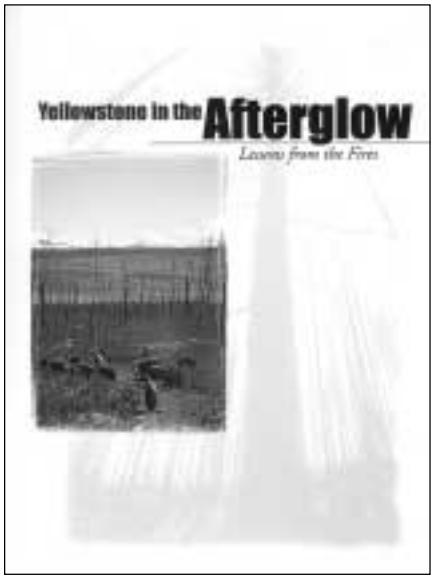

On the cover: Black-Billed Magpie, photo by Terry McEneaney. Left: Obsidian Cliff, NPS photo. Above: Yellowstone in the Afterglow: Lessons from the Fires, *a new publication now available from the park.*

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Yellowstone Science is published quarterly, and submissions are welcome from all investigators conducting formal research in the Yellowstone area. Correspondence should be sent to the Editor, *Yellowstone Science*, Yellowstone Center for Resources, P.O. Box 168, Yellowstone National Park, WY 82190.
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Yellowstone Christmas Bird Counts of the Twentieth Century

by Terry McEneaney

Mallards were one of the six bird species found on all 28 Yellowstone Christmas Bird Counts. Photo by Terry McEneaney.

December 17, 2000, marked the last of 28 Yellowstone Christmas Bird Counts (YCBCs) conducted during the twentieth century. Park naturalist Milton Skinner completed the first YCBC on December 23, 1920. That day, a total of 14 bird species representing 1,196 individuals were counted. Skinner conducted the original survey on horseback, traveling 22 miles through one to five inches of snow, with temperatures ranging from 0 to18° F. Naturalists William E. Kearns and David deLancey Condon conducted the second YCBC on December 19, 1939. Temperatures that day ranged from 21 to 34° F, with snow found only in the higher elevations. They split up to cover a total of 20 miles on foot, and tallied 21 bird species representing a mere 432 individuals.

From 1975 through the end of the twentieth century, the YCBC has been conducted annually. Regardless of weather conditions or number of birds detected, the YCBC has sparked public interest in wintering birds, as evidenced by the slow but steady increase in participants—the tradition continues. What is the origin of the Christmas Bird Count? What is it like? Of what value are the data? What have we learned? This article attempts to answer these questions and to explain why people participate in the winter event called the Christmas Bird Count.

Skinner conducted the original survey on horseback, traveling 22 miles through one to five inches of snow, with temperatures ranging from 0 to18° F.

History of the Christmas Bird Count

The concept and proposal for the first Christmas Bird Census appeared in the December 1900 issue of *Bird Lore*, the precursor of *Audubon Nature Notes*. The brainchild of this event was none other than Frank Chapman, the editor of *Bird Lore* and one of the prominent ornithologists of the twentieth century. Chapman was disturbed, as were other conservationists, by the slaughter of wildlife in an annual holiday event in the eastern United States, during which all forms of wildlife were shot. Basically, the team that shot the most birds and mammals during the hunt was declared the winner. In protest, Chapman convinced 27 friends in 25 different locations nationwide to set aside December 25, 1900, as a day for a large-scale bird count. Instead of shooting birds, they decided to count them—hence the name.

Much has changed since the original Christmas Bird Count (CBC) took place. Today, more than 50,000 people from a vast area including all 50 United States, all Canadian provinces, the Caribbean, Central and South America, and the Pacific Islands participate in more than 1,800 Christmas Bird Counts annually.

Methods

The methods established for the Christmas Bird Count are simple and have changed very little over time. The count day can occur any time during a two-and-

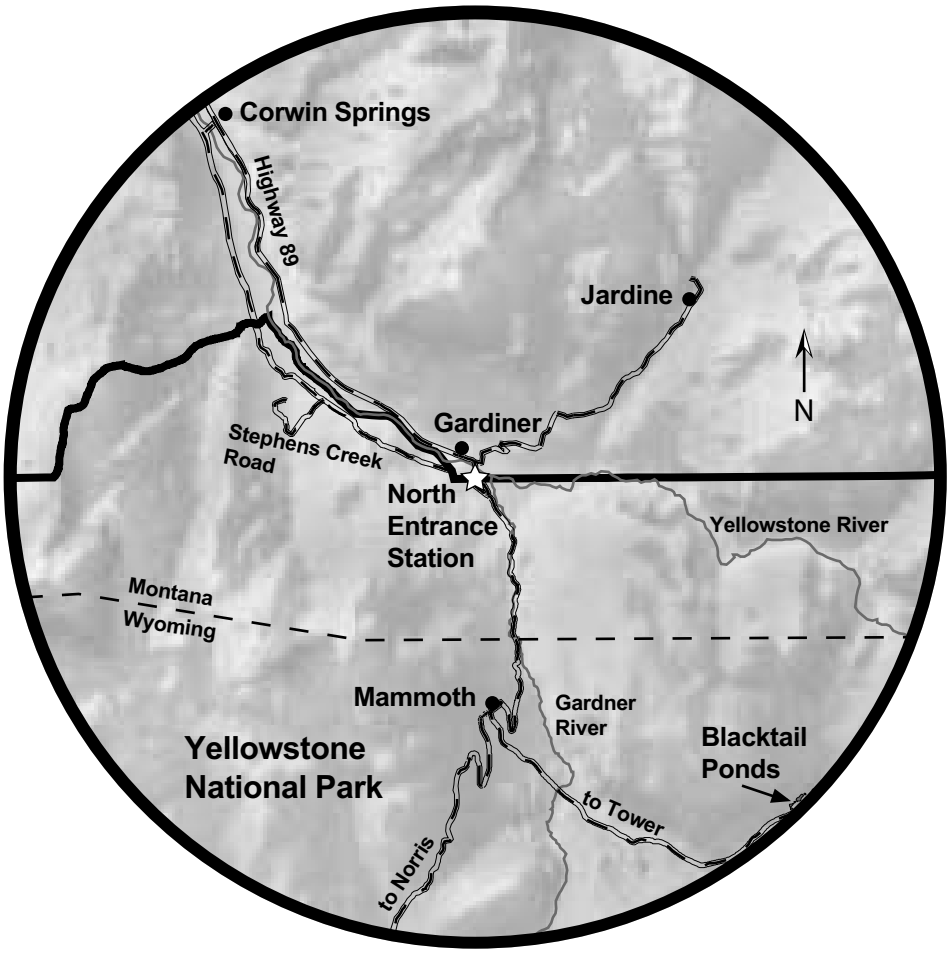

Figure 1. The Yellowstone Christmas Bird Count area is a circle having a 7.5-mile radius, centered at Yellowstone's North Entrance station (map scale: 1 inch = 3 miles). Map by the Spatial Analysis Center and Tami Blackford.

Swan Lake Flats. The number of bird species and individual birds have been reliably higher at lower elevations during Yellowstone Christmas Bird Counts. Photo by Terry McEneaney.

TABLE 1. 26 MOST FREQUENTLY DETECTED BIRD SPECIES (>50%)—YELLOWSTONE CHRISTMAS BIRD COUNTS, 1920–2000, BASED ON 28 YEARS OF DATA

	Years Detected			Years Detected	
Species	**No.**	**%**	**Species**	**No.**	**%**
Mallard	28	100%	Belted Kingfisher	23	82%
Clark's Nutcracker	28	100%	Black Rosy Finch	20	71%
Black-Billed Magpie	28	100%	Dark-Eyed Junco	20	71%
Common Raven	28	100%	Red-Breasted Nuthatch	20	71%
American Dipper	28	100%	Rock Dove	18	64%
Townsend's Solitaire	28	100%	Common Snipe	18	64%
Black-Capped Chickadee	27	96%	Northern Flicker	18	64%
Mountain Chickadee	27	96%	Common Goldeneye	16	57%
Bald Eagle	26	93%	Northern Shrike	16	57%
Golden Eagle	26	93%	Hairy Woodpecker	16	57%
Gray-Crowned Rosy Finch	26	93%	Downy Woodpecker	15	53%
Bohemian Waxwing	25	89%	Steller's Jay	14	50%
Green-Winged Teal	25	89%	American Tree Sparrow	14	50%

TABLE 2. 12 MOST ABUNDANT BIRD SPECIES—YELLOWSTONE CHRISTMAS BIRD COUNTS, 1920–2000, BASED ON 28 YEARS OF DATA

Species	No. Individuals	No. Yrs. Detected	Average No. Birds per Year
Bohemian Waxwing	10,546	25	421.8
Gray-Crowned Rosy Finch	5,442	26	209.3
Common Raven	4,031	28	143.9
Mallard	2,282	28	81.5
Black-Billed Magpie	2,244	28	80.1
Mountain Chickadee	1,591	27	58.9
American Dipper	1,472	28	52.6
Rock Dove	1,386	18	77.0
Townsend's Solitaire	1,283	28	45.8
Clark's Nutcracker	729	28	26.0
Black Rosy Finch	713	26	35.7
Black-Capped Chickadee	348	27	12.4

one-half–week period between December 14 and January 5. Each bird count encompasses a 177-square-mile area—a circle measuring 15 miles in diameter, or a 7.5-mile radius from a center point. The YCBC center point is the North Entrance station in Yellowstone National Park, one-half mile south of Gardiner, Montana (Figure 1). The perimeter of the count circle extends in the northeast to Jardine, Montana; in the south to Mammoth, Wyoming; in the southeast to Blacktail Ponds in the park; and in the northwest to Corwin Springs, Montana. An unlimited number of people may participate in this event. Avian species associated with bird feeders at private residences are also allowed to be part of the total tally. Participants cover as much of the circle as possible within a 24-hour calendar day, counting all individual birds and species encountered within the designated area. The count leader assigns routes within the count area to avoid recounting of the same birds. The same areas are covered fairly well each year; however, one of the principal drawbacks of this method is the lack of established census routes and observation points that are essential for developing meaningful population trends. CBC data are compiled and sent to the National Audubon Society and later appear in an annual publication entitled *American Birds*.

YCBC Data

Most of the people involved in Christmas Bird Counts are not professional ornithologists. These "citizen scientists," as they are now called, contribute a significant amount of information on birds in general; however, this body of knowledge must be treated carefully. While many professional ornithologists treat this information with scientific caution, recent advances in the summary and analysis of CBC data has resulted in a somewhat greater scientific use of this information than was previously thought possible, to track general national population trends and changes in winter ranges.

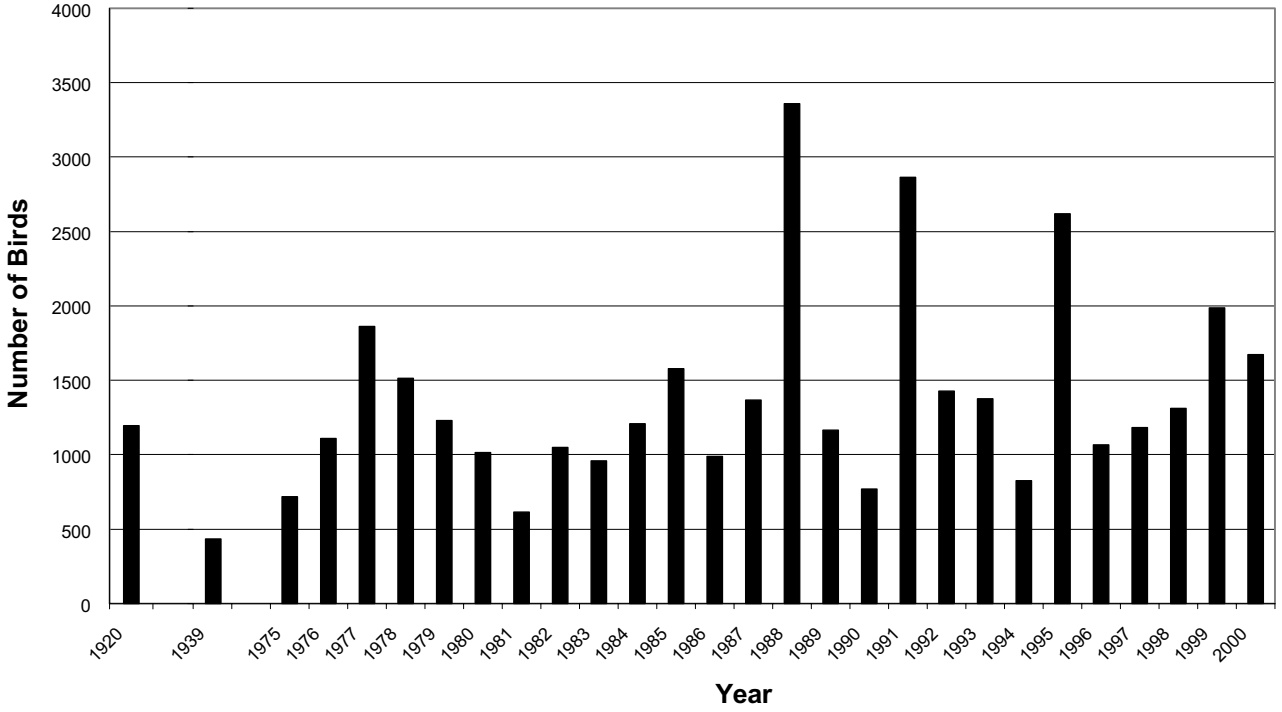

Figure 2. Number of Individual Birds, Yellowstone Christmas Bird Count.

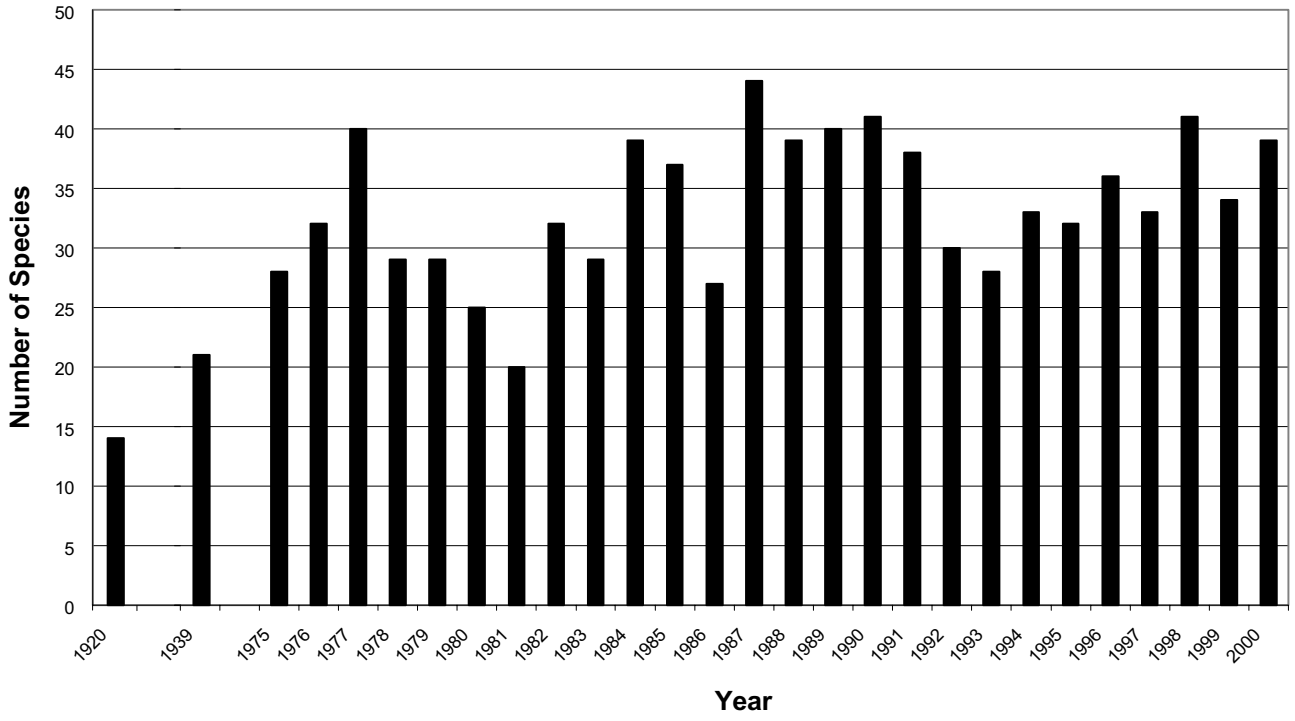

Figure 3. Number of Bird Species, Yellowstone Christmas Bird Count.

The Gardner River. Thermally-warmed open water provides important winter habitat for birds. NPS photo.

The strength of the YCBC data is in the qualitative information it provides, such as weather conditions; relative abundance of particular bird species; availability of food; notes on obvious food sources, such as aquatic vegetation and insects, juniper berries, seed cone crops, and available prey; and notes on unusual numbers of individuals of a species. For example, the 26 bird species most frequently observed during the 28 years of conducting YCBCs can be clearly established (Table 1). Also, winter relative abundance can be determined (Table 2). In addition, a histogram plotting trends of individual birds over time can be developed (Figure 2), as can a histogram of species detected during YCBCs (Figure 3). However, population trends for individual species cannot be ascertained because of the lack of standardized census methodology and uncontrolled variables, such as weather. Although only limited quantitative information can be extracted from the data, a vast amount of qualitative information has resulted in the following findings:

- Ninety-five species were detected during the 28 years that YCBCs were conducted (Table 3). Of that total, only 26 species were found at least half of those years. The remaining 69 species were either uncommon, erratic (wandering), or rare.
- The number of bird species observed has varied between 14 in 1920, and 44 in 1987.
- The number of individual birds observed has varied between 432 in 1939, and 3,357 in 1988.
- The average number of bird species observed per YCBC was 33.
- The average number of individual birds observed per YCBC was 1,373.
- The highest number of individuals of any one species observed was 2,081 Bohemian Waxwings in 1988.
- Bohemian Waxwings, Rosy Finches (Gray-Crowned and Black combined), and Common Ravens were the most numerous birds detected during the 28 years of conducting YCBCs.
- Food and habitat availability play vital roles in winter bird distribution.
- The YCBC represents a true reflection of winter-like conditions in a mid-elevation (montane) to lower elevation (foothill) mountainous environment. Winter information of this type, collected during YCBCs, is rarely collected elsewhere in mountainous habitats.
- Winter weather is highly variable and probably the single most important factor influencing bird distribution and abundance.
- The lower the elevation, the more bird species and individuals one is likely to encounter in winter. The number of wintering bird species and individuals detected are reliably higher in the Gardiner, Montana, area than in the Mammoth, Wyoming, area.
- No two winters are the same. Temperatures and snowfall vary from day to day, month to month, and year to year.
- Caution should be exercised when judging winter-like conditions based on a single day. Regional weather patterns do not take into account microsite differences, such as snow depth, temperature pockets, and chinook winds.
- Natural features, such as thermal areas and the extent of open water, play important roles in luring migrant or wintering birds.
- Artificial features such as bird feeders and ornamental shrubs and trees have played important roles in winter bird distribution and abundance in the Gardiner/Mammoth area. Regular- or late-season elk-hunter success has played an important role in predatory and scavenging bird distribution and abundance in the Gardiner/Mammoth area.
- In recent years, Rock Doves, House Sparrows, European Starlings, and House Finches have overwintered and nested in the area, primarily with the assistance of bird feeders, artificial structures, and ornamental plants.
- Bird feeders are much more effective in luring birds during cold temperatures than in mild ones.
- Years with exceptional numbers of individual birds usually have been eruptive years for Bohemian Waxwings, when they comprised up to 62 percent of the total individual birds counted. Rosy Finches (Gray-Crowned and Black combined) also have comprised up to 84 percent of the total individuals observed during some peak years.
- The total number of observers participating in a YCBC has not appeared to reflect the number of individuals or species detected.
- The most ideal winter weather conditions for counting the maximum number of bird species and individuals during a YCBC are moderate to heavy snows, and low to moderate

temperatures. Under these conditions, birds are more concentrated and are restricted to narrow habitats having available food. A lack of snow or extremely mild temperatures result in the opposite—natural foods are more available and birds are more widely distributed.

• Most erratic and rare bird species detected during the YCBC have been closely associated with bird feeders, thermal areas, and areas of exposed open water.

• The most unusual or erratic birds detected on the YCBC to date include:

–Virginia Rail (1996, 1998, 1999; Mammoth, WY);

–Winter Wren (1998; Mammoth, WY);

–Hoary Redpoll (1984; Gardiner, MT);

–Sharp-Tailed Grouse (1996; Gardiner, MT);

–Northern Mockingbird (1998; Gardiner, MT); and

–Swamp Sparrow (1994; Mammoth, WY), the first record of this species in Yellowstone National Park.

• Because winter conditions arrive earlier at higher elevations, winter conditions reliably prevail during YCBCs, making them highly reflective of wintering bird species. At lower elevations, winter conditions may not prevail by Christmas, making those CBCs less reflective of birds that may occupy those areas later that winter.

Personal Experience and Summary

During Yellowstone Christmas Bird Counts I have witnessed a number of wonderful sightings including a Northern Goshawk chasing Rock Doves, a Merlin chasing an American Dipper, and a Northern Shrike flying with a vole in its talons and transferring the vole to its beak while in flight. I have had opportunities to snowmobile, ski, walk, fall, slide, sit in a vehicle, and even bathe in a hot spring while looking for birds. I have come across hundreds of wonderful finds including wolverine tracks in the snow, river otter swimming in the Gardner River, a white-tailed jackrabbit population eruption, and a Bald Eagle roost. During YCBCs, I have seen hundreds of Bald and Golden Eagles and Townsend's Solitaires, and thousands of Gray-Crowned Rosy Finches and Bohemian Waxwings. I have had the opportunity to observe both rare and vagrant birds. I have experienced unusual weather conditions—so mild that you thought you were in California, snow coming down so hard you could barely see 50 feet in front of you, other times it was so cold you couldn't run to the car fast enough. The YCBC is more than just watching and counting birds in the winter. It is about putting up with the elements, developing friendships, and gaining field experience. It is also personally gratifying to watch people improve their field skills over time.

You may ask, if the data has limited application, why even conduct a Christmas Bird Count? For me, it is more than watching and counting birds. It is a social event beyond the scope of scientific knowledge. It is a winter ornithological tradition. I look forward to the twenty-first century and continuing the Yellowstone Christmas Bird Count tradition.

Terry McEneaney is the ornithologist for Yellowstone National Park and author of several books on the birds of Yellowstone and Montana. Photo courtesy Terry McEneaney.

Ruffed grouse, birds of woodlands and forest edges, have been observed on five of 28 YCBCs. NPS photo.

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TABLE 3. BIRDS OBSERVED DURING YELLOWSTONE CHRISTMAS BIRD COUNTS, 1920–2000.

Species	1920	1939	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Highest #:year
Pied-Billed Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1:1991
Great Blue Heron	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1:1975,97,00
Canada Goose	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	46	-	-	-	-	-	-	-	-	34	275	-	275:1999
Green-Winged Teal	5	-	4	10	6	2	4	-	-	22	21	12	6	10	8	6	7	12	5	10	8	18	23	17	14	7	27	53	53:2000
Mallard	85	53	127	74	60	167	160	56	45	96	197	82	141	146	63	90	107	110	8	32	25	26	52	61	36	51	54	78	197:1983
Northern Pintail	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5:1982
Blue-Winged Teal	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2:1975
Northern Shoveler	-	-	-	-	-	-	-	-	-	-	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26:1984
Gadwall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2:1995
American Wigeon	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1:1984,96
Common Goldeneye	8	-	27	-	13	17	1	21	-	1	-	9	15	11	2	1	-	5	1	-	-	-	-	1	-	14	-	-	27:1975
Barrow's Goldeneye	-	-	26	1	30	8	1	-	-	-	-	62	81	44	*	5	1	3	-	-	-	2	-	1	-	-	-	-	81:1985
Common Merganser	1	-	-	-	-	-	-	-	-	4	3	-	1	-	8	2	-	2	-	-	-	2	1	1	4	-	6	-	8:1987
Bald Eagle	-	-	2	4	3	4	2	4	4	9	11	9	24	9	11	48	16	10	47	6	6	25	4	8	10	5	15	18	48:1988
Northern Harrier	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-	1:1984,90
Sharp-Shinned Hawk	-	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	1	-	1:1978,79,96,99
Cooper's Hawk	-	-	-	-	-	-	-	1	-	3	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	3:1982
Northern Goshawk	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1:1976,85,90
Red-Tailed Hawk	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2:1939
Rough-Legged Hawk	-	-	-	-	2	-	-	-	-	1	1	-	-	-	-	-	-	1	7	1	-	*	-	1	1	2	-	1	7:1991
Golden Eagle	-	1	6	2	7	5	1	6	9	5	8	3	10	4	5	6	7	2	2	12	-	8	4	8	3	1	12	6	12:1992,99
American Kestrel	-	-	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	1	-	1:1976,97,99
Merlin	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	*	-	-	1	-	*	*	-	-	-	-	-	1:per year
Prairie Falcon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	*	-	-	-	-	-	-	1	-	-	1	1:1988,97,00
Gray Partridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	1:1997
Blue Grouse	-	-	-	1	7	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	7:1977
Ruffed Grouse	-	-	-	2	2	-	-	-	-	-	2	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	1	-	10:1987
Sharp-Tailed Grouse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1:1996
Virginia Rail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	2	*	2:1998,99
American Coot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1:1989
Killdeer	-	-	-	-	1	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2:1983
Common Snipe	1	-	2	2	3	1	2	-	-	-	-	1	2	-	2	1	4	4	1	-	-	-	1	2	2	1	-	3	4:1989,90
Rock Dove	-	-	-	-	-	-	-	-	-	-	35	47	53	54	90	355	65	24	57	35	48	43	43	59	49	29	152	148	355:1988
Great Horned Owl	-	-	*	*	2	-	-	-	-	-	2	4	-	1	*	1	-	1	*	*	*	1	-	-	-	-	1	*	4:1984
Northern Pygmy Owl	-	-	-	-	-	1	-	1	1	1	-	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1:per year
Short-Eared Owl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	1:1994
Northern Saw-Whet Owl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	1:1999
Belted Kingfisher	1	-	2	4	4	3	1	5	2	6	1	3	1	5	2	5	3	4	*	3	*	1	-	1	2	*	3	4	6:1982
Downy Woodpecker	-	1	-	1	1	1	1	4	-	3	-	-	1	1	-	3	2	-	1	1	-	*	-	-	-	1	-	1	4:1980
Hairy Woodpecker	-	2	1	1	3	-	-	-	-	1	-	1	3	9	6	4	1	-	1	2	-	2	-	-	1	-	-	1	9:1986
Three-Toed Woodpecker	-	1	-	-	-	-	-	-	-	-	1	3	5	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-	5:1985
Northern Flicker	-	-	1	-	-	-	2	3	3	2	2	1	-	-	4	1	*	2	2	1	1	1	1	*	-	1	3	3	4:1987
Horned Lark	-	-	-	-	-	25	1	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	4	-	25:1978
Gray Jay	-	5	-	2	1	2	2	2	1	-	-	1	-	-	4	3	11	1	2	-	-	-	-	-	-	-	-	-	5:1939
Steller's Jay	-	-	-	-	4	-	9	2	1	-	-	-	1	-	1	2	-	1	-	-	1	3	2	-	5	1	-	3	5:1997
Blue Jay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	-	2:1994
Pinyon Jay	-	-	-	-	2	-	-	-	-	-	-	-	33	-	28	11	8	12	-	50	25	30	*	40	-	24	7	10	50:1992
Clark's Nutcracker	4	26	19	7	23	50	27	43	2	4	5	19	24	12	35	26	97	27	40	18	16	12	133	15	4	2	30	9	133:1995
Black-Billed Magpie	21	35	96	121	48	88	95	68	65	88	84	70	103	70	69	102	75	101	70	58	78	133	80	79	150	66	66	65	150:1997
American Crow	-	-	-	-	2	-	-	-	-	-	-	-	6	-	-	-	3	-	43	5	-	17	-	-	-	-	-	-	43:1991
Common Raven	2	46	105	83	169	76	169	78	98	108	169	93	429	190	222	166	118	83	263	246	146	226	117	155	135	105	83	151	429:1985
Black-Capped Chickadee	-	5	11	26	24	4	1	1	3	2	6	11	11	9	30	23	14	28	14	1	19	31	16	16	10	7	14	11	31:1994
Mountain Chickadee	-	65	52	144	80	135	85	42	25	35	69	74	103	86	219	104	34	6	18	6	50	30	71	6	27	7	3	15	219:1987

Red-Breasted Nuthatch	-	1	1	*	-	1	-	-	1	5	5	33	3	11	24	19	1	11	15	1	2	2	25	4	-	-	-	5	33:1984
White-Breasted Nuthatch	-	1	-	4	-	-	-	-	3	1	-	2	1	-	4	3	4	-	2	-	-	-	-	-	-	-	-	-	4:1976,87,89
Brown Creeper	-	-	-	3	3	4	1	4	-	-	-	1	-	-	11	1	-	-	-	2	-	-	-	1	-	-	2	-	11:1987
House Wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1:1997
Winter Wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	1	-	-	1:1994,98
Marsh Wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	*	2	2:2000
American Dipper	59	25	76	69	42	39	59	40	33	32	56	100	100	122	124	77	85	49	54	39	21	34	15	22	27	8	32	33	124:1987
Golden-Crowned Kinglet	-	-	-	1	4	-	-	-	-	2	-	-	-	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	4:1977
Townsend's Solitaire	3	7	28	44	42	72	25	56	13	29	41	40	54	44	80	106	54	21	88	7	52	55	94	55	59	10	51	53	106:1988
American Robin	-	-	-	4	-	-	1	22	-	1	-	-	5	-	3	9	-	-	*	-	-	8	-	-	-	-	-	2	22:1980
Gray Catbird	-	-	-	-	-	-	-	3	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3:1980
American Pipit	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:1976
Northern Mockingbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1:1998
Bohemian Waxwing	-	39	7	390	995	600	407	514	105	450	-	113	205	138	156	2081	8	-	1724	50	71	13	1455	35	350	120	393	127	2081:1988
Cedar Waxwing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	53	-	30	-	3	5	1	-	52	-	1	1	9	53:1988
Northern Shrike	-	-	1	*	2	1	2	1	-	-	-	5	1	-	*	2	-	4	3	3	2	-	2	-	1	1	-	1	5:1984
European Starling	-	-	4	1	-	1	-	-	-	-	-	-	7	-	15	-	1	15	-	-	3	2	1	-	-	*	*	6	15:1987,90
Yellow-Rumped Warbler	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	1:1983,87,90
Spotted Towhee	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:1982
American Tree Sparrow	-	-	-	9	33	-	1	-	-	-	27	9	15	-	1	25	35	-	1	12	-	-	29	6	-	16	-	-	35:1989
Fox Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1:1987
Song Sparrow	3	-	-	*	-	-	-	-	-	-	1	-	1	1	3	6	3	2	1	*	*	*	*	2	*	2	3	5	6:1988
Swamp Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1:1994
White-Throated Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	*	-	-	-	1	-	-	1:1990,94,98
White-Crowned Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	*	-	*	-	-	-	*	-	-	1:1991,92,94,98
Harris' Sparrow	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	1	1	1	-	*	-	-	-	-	3	1	2	3:1998
Dark-Eyed Junco	-	7	12	-	87	4	-	1	-	2	-	6	1	4	1	-	-	1	13	4	2	6	17	5	4	16	-	7	87:1977
Snow Bunting	-	-	-	*	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	*	-	-	-	-	2:1989
Red-Winged Blackbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-	-	-	1	-	-	3:1990
Brewer's Blackbird	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6:1977
Common Grackle	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1:1979,93
Gray-Crowned Rosy Finch	852	1	80	45	9	150	126	35	150	105	175	168	112	-	42	1	143	125	276	770	685	*	21	233	65	508	370	195	852:1920
Black Rosy Finch	151	-	-	15	20	40	40	-	51	20	16	24	16	-	10	-	24	25	21	40	37	*	37	10	28	59	24	5	151:1920
Pine Grosbeak	-	-	-	-	10	8	-	-	-	-	-	-	-	3	8	-	6	-	-	-	-	-	1	4	-	-	1	-	139:1997
Cassin's Finch	-	77	-	-	-	-	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	10	-	-	-	*	-	77:1939
House Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	11	10	3	7	53	13	44	139	45	136	126	139:1997
Red Crossbill	-	-	-	-	6	-	-	-	-	5	-	-	-	-	-	5	3	2	-	-	-	-	280	-	1	-	-	145	280:1995
White-Winged Crossbill	-	-	-	-	-	-	-	-	-	-	-	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54:1984
Common Redpoll	-	-	14	16	96	-	-	-	-	-	-	66	-	-	-	-	148	-	10	5	12	1	3	-	-	3	11	-	148:1989
Hoary Redpoll	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2:1984
Pine Siskin	-	-	-	-	-	3	-	-	-	-	-	12	-	1	-	-	-	-	1	-	12	1	63	11	4	10	-	322	322:2000
American Goldfinch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	4	13	1	2	*	1	-	-	*	*	7	13:1991
Evening Grosbeak	-	-	2	21	8	-	-	-	-	-	8	39	-	-	14	1	21	22	45	*	-	*	-	60	-	20	-	-	45:1991
House Sparrow	-	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	35	*	46	43	125	201	38	201:1999

TOTALS

Species (Day/Week)	14/0	21/0	28/1	32/6	40/0	29/1	29/1	25/0	20/0	32/0	29/0	39/0	37/0	27/0	44/3	39/0	40/2	41/2	38/3	32/4	28/4	33/12	32/4	36/4	33/3	42/4	34/5	39/2	
Individuals	1196	432	719	1109	1861	1512	1228	1013	615	1050	960	1208	1577	989	1366	3357	1166	769	2863	1428	1377	825	2617	1064	1180	1313	1986	1672	

** Found during count week.*

Total Number of Years of YCBC = 28
Average Number of Species per YCBC = 32.6
Average Number of Individuals per YCBC = 1,373.3
Highest Number of Individuals = 3,357 in 1988
Highest Number of Species = 44 in 1987

Highest Number of Species (including count week) = 47 in 1987
Highest Number of Individuals of Any One Species = 2,081 Bohemian Waxwings in 1988
As of 2000, Total Species Recorded During YCBC = 95
As of 2000, Total Species Recorded During YCBC and Count Week = 97

Time Machine

by Alice Wondrak

When the "Nature Notes" came into being in 1920 [see Schullery and Whittlesey, Yellowstone Science *8(1)], folks in Yellowstone weren't as concerned with what would come to be known as the park's "cultural resources" as we are today. This installment might be more aptly titled "Culture Notes."*

As a child who was fortunate enough to visit Yellowstone during each of my formative summers, the culture of nature held an early fascination for me—the most exciting thing to me at Old Faithful was always more the inn than the geyser. Walking into the inn was like walking into a roomful of sky in the midst of a forest glen—the sun even shone bright white circles down onto its floor, and if you were a careful looker, you could trace their beams all the way back up to a tiny hole in the logs of the impossibly high ceiling. And then there was that clock.

Designed by Old Faithful Inn architect Robert Reamer specifically for the inn, the clock reaches the top of the inn's three stories that are accessible to visitors, and sports a 13-foot pendulum. Originally fitted with wooden hands, it was made around 1903 by Livingston blacksmith George Colpitts, who also fashioned the inn's fireplace set and andirons. If there was ever a "machine in the garden," this was it.

Reamer didn't have to hang a gigantic clock from the side of the inn's giant chimney, which might lead us to wonder why it's there, outsizing even the fireplace and its proportionally massive andirons. Regardless of whether its maker simply intended to let everyone know what time it was, the clock's power to awe makes our relationship with the concept of time in Yellowstone worth considering. It is, after all, one of the reasons that Yellowstone exists as a national park today—Old Faithful didn't become Yellowstone's primary icon and the world's most famous geyser by accident. It captured the imaginations of its first observers

because it was a figment of nature which seemed to conform to the rhythm of the human experience. So appealing was this notion that the myth that the geyser erupts "once an hour, on the hour" remains fixed in the minds of many visitors today, despite the park's best efforts to convince them that the geyser runs on its own "schedule."

Standardized time and schedules themselves were newish concepts at the turn of the twentieth century when the clock was built. Until the transcontinental railroad physically linked the entire North American continent in 1869, it hadn't really mattered if it was simultaneously 8:56 in Chicago and 9:03 in Denver. Timekeeping that was both accurate and universal became an American cultural obsession only after the timetable—a creation of the same railroad system, oddly enough, whose Northern Pacific financed the first major explorations of the Yellowstone area and bankrolled the construction of the Old Faithful Inn (and its clock)—necessitated the making of time zones in the U.S. The nation synchronized its watches in 1883, the same year that the Northern Pacific Railroad first brought visitors to Yellowstone via its terminus at Cinnabar, Montana. If the park brought Americans together ideologically, the railroad brought them together physically in a place whose main attraction was the apparent convergence of nature's wonder and culture's order.

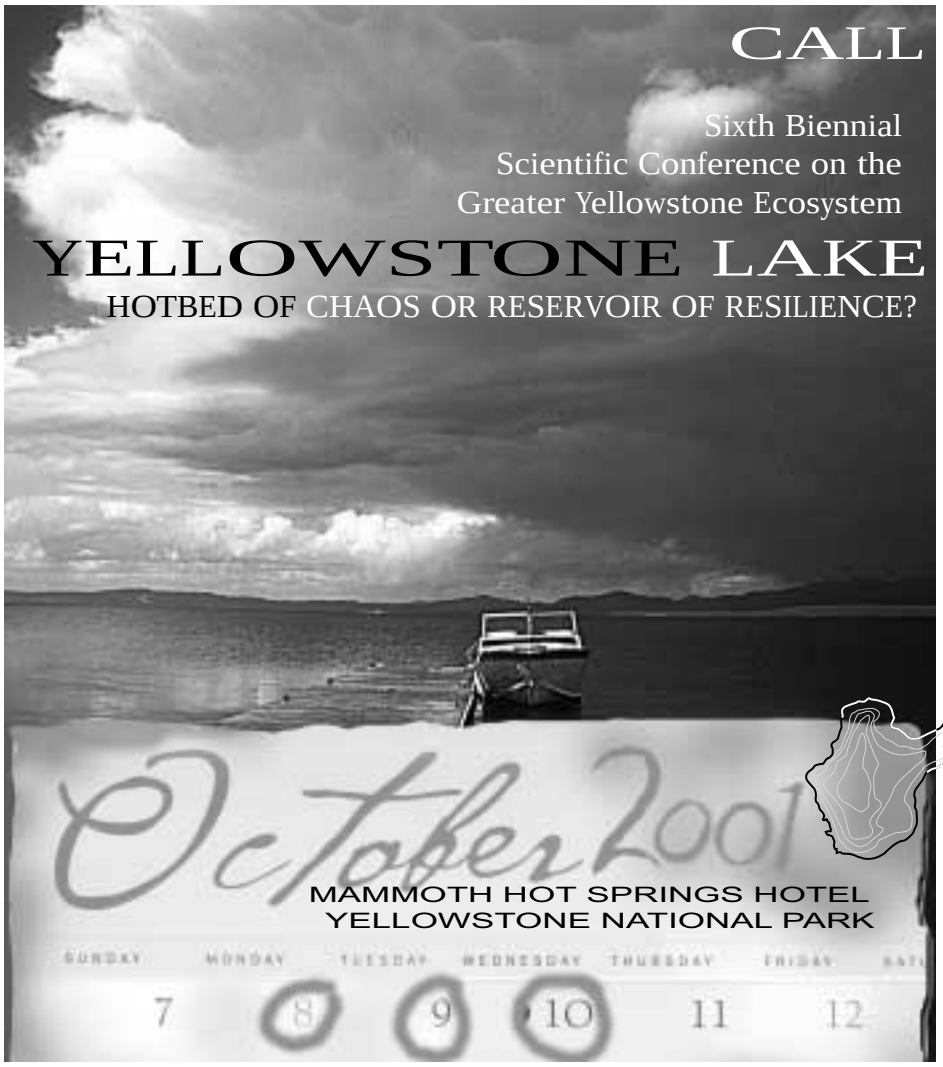
Old Faithful Inn's clock. NPS photo.

Of course, Reamer's clock could always just remind you that it was time to get out onto the deck and see if the geyser had started to blow. If the clock represents the importance of human time in Yellowstone's history, it equally represents the importance of geologic time in its creation. We know that Old Faithful erupts fairly regularly; we also know that it didn't sp(r)out up overnight.

If we know anything else about Yellowstone, it's that change is the only constant over time. Unfortunately, however, this has also been the case with the inn's clock. It had ceased to be faithful in recent years, and in 2000 was retro-fitted by an interdisciplinary team of Livingston historian Dick Dysert, Anaconda machinist Mike Kovacich, and Bozeman clock expert Mike Berghold, who rebuilt its works "from scratch." Today the clock's pendulum swings again, marking the minutes until the next geyser eruption, dinner date, or interpretive talk for guests who are anxious to learn more about the inn, the geysers, and their past times.

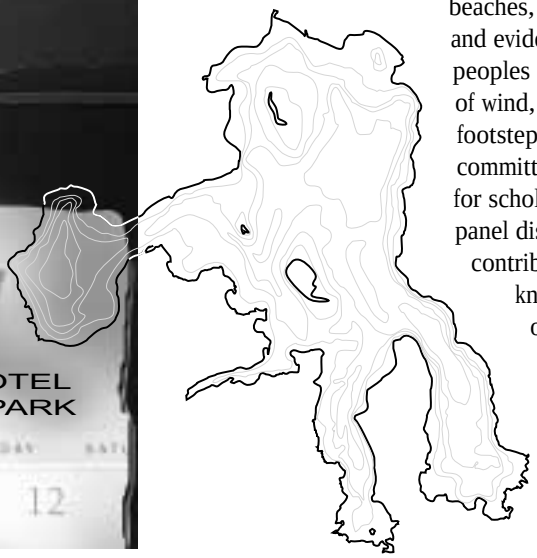
Alice Wondrak is a writer-editor at the Yellowstone Center for Resources. She is also a 1999 Canon National Parks Science Scholar and a doctoral student at the University of Colorado–Boulder. She is exploring the environmental history of the "Yellowstone bear," from tourism icon to ecological indicator. Photo courtesy Alice Wondrak.

CALL FOR PAPERS



The purpose of the greater Yellowstone conference series is to encourage the awareness and application of wide-ranging, high-calibre scientific work on the region's natural and cultural resources. We encourage multidisciplinary presentations and interdisciplinary discussions about the relationships between the regional landscape and its residents of many species.

The Sixth Biennial Conference will focus on a central feature of the ecosystem's landscape, Yellowstone Lake—from its depths, where submerged hot springs and spires emerge atop the Yellowstone caldera, to its beaches, where rare plants and evidence of prehistoric peoples erode at the mercy of wind, waves, and modern footsteps. The program committee invites proposals for scholarly papers and panel discussions that contribute to professional knowledge and debate on the following topics or others that relate to the Yellowstone Lake basin and its human and natural history.



- Hydrology, geology, geochemistry, and geophysics
- Plants, fish, and other wildlife in or around the lake
- Invertebrates and microfauna
- Archeology and human history of the lake basin
- Socioeconomic values associated with Yellowstone Lake and its resources
- Issues related to recreational use of or around Yellowstone Lake
- Management of natural or cultural resources

HOW TO SUBMIT AN ABSTRACT

Please submit a one-page, double-spaced abstract of proposed papers or panel sessions, on diskette or as an attachment via electronic mail (Word, Word Perfect, or ASCII format) by March 15, 2001, to: Program Committee, Yellowstone Center for Resources, P. O. Box 168, Yellowstone National Park, Wyoming 82190; email: Michelle_Le_Beau@nps.gov. See www.nps.gov/yell/technical/conference.htm for information and forms. Abstracts will be published in the conference agenda booklet. Authors of selected papers and panelists will be notified by May 15, 2001.

REGISTRATION INFORMATION

The conference will be held at the Mammoth Hotel in Mammoth Hot Springs, Wyoming, the headquarters for Yellowstone National Park. This call will be followed by all necessary information on conference registration, accommodations, and related details. Please contact Michelle LeBeau at (307) 344-2239 for more information.

The Evolution of Cultural Resources Management in Yellowstone

An Interview with Laura Joss

Laura Joss. NPS photo.

In March 2000, Laura Joss, chief of Yellowstone's Branch of Cultural Resources from 1994 to 2000, became superintendent of Fort McHenry National Monument and Historic Shrine and Hampton National Historic Site, both located in Baltimore, Maryland. Laura received a B.A. in Anthropology from Indiana University, and an M.A. in History Museum Studies from the Cooperstown Graduate Program. She started with the National Park Service as a volunteer at Mesa Verde National Park, and has worked as either staff or consultant at several other national parks and museums. Prior to her departure from Yellowstone, she talked with Yellowstone Science *staff about overseeing cultural resources management here.*

***Yellowstone Science (YS)*:** Thinking back to before you came, what made you want to come to Yellowstone and take on this challenge?

***Laura Joss (LJ)*:** I had a great experience here as acting chief of interpretation for three months in 1992, and I really enjoyed the resources and the people. When I was offered this position in 1994, I thought it was a great opportunity to build a new program, work with some really good professionals, and get to know the resources better.

***YS*:** It seems in the last decade, we've had great growth in the cultural resources program. What was the staff size when you got here and how has it grown?

***LJ*:** When I arrived, there were two permanents, one seasonal, and two part-time Yellowstone Association (YA) employees. Now we have five permanent and five term employees, as well as the same two YA employees. My intent was to base the growth on the need for resource inventories and establish at least one person in each program: archeology, anthropology, cultural landscapes, ethnography, historic structures, and the museum, library, and archives. We still need a librarian, although we now have a term library technician. We are getting closer to the positions that we need to flesh out each program. When we progress far enough along with our inventories, we'll get more into researching the collections and to better protection and monitoring. It is being done a little now, but I think we need a lot more of that along the road.

***YS*:** How would you describe the state of the program when you arrived?

***LJ*:** The program had been created from staff then-assigned to interpretation or planning. The positions were pulled into one branch, but it wasn't very cohesive at that time. One thing I tried to work with quite a bit was making the branch members feel like more of a team and getting a common vision of the program, and getting our goals delineated. I feel like those stones have been put in place—the foundation is there now.

One program that was an emphasis for Tom Tankersley, who was the cultural resource contact, was working with tribal people. That was something I had done a little of when I got here, but it really hit us big time with the bison plan and Environmental Impact Statement (EIS), when we did more face-to-face consultations with tribes. The list of tribes that have expressed concern or interest about bison has grown to 84. I have worked hard, not just for the bison program but for all programs in the park, to have a regular consultation schedule with tribes, which is now twice a year. And I have tried to increase the tribal presence in the park through employment opportunities. Whenever we have a big training here, I ask if we can get slots for tribal members and we've had some tribal people come for those. The tribes do some contract work for us, particularly with cultural resources. We also facilitate traditional uses—sweat lodges and other ceremonies—in the park by tribal people. A lot of teachings go on in the park by tribal people who have used this area for gen-

erations. Superintendent Mike Finley really helped facilitate that when he agreed to a fee waiver for tribal people coming in for traditional activities.

***YS*:** Before coming to Yellowstone you were the Rocky Mountain regional curator?

***LJ*:** Yes. I was there for three and a half years and had oversight of the curatorial program for 41 parks in this region.

***YS*:** How does Yellowstone's curatorial program match up, and what are its challenges?

***LJ*:** Well, it is one of the larger programs in the region, and I became familiar with it when I was in Denver because we were subject to an inspector general's audit which cited us for our problems with the museum environment and storage areas. Yellowstone and other parks that were cited received increased attention to correct those deficiencies. All the parks on that list have corrected their deficiencies, except Yellowstone. We have done everything we could within the current location, but overcrowding is a big problem. Susan Kraft [Yellowstone's museum curator] has worked very hard to make improvements within her storage area, but there are still a lot of problems with the Albright Visitor Center basement. That's why we've been planning for a new building for some time. That planning has gone through several iterations here in the park because different sites were targeted at different times. In the course of considering those, doing subsurface testing and compliance, the process has now evolved to the point that we have four sites we're looking at. One is at the edge of Gardiner and the other three are in upper Mammoth [site of park headquarters]. Because of some of the compliance issues in Mammoth, which includes the Fort Yellowstone historic district, and the potential for future growth, we're looking at the Gardiner site very closely as our preferred site.

***YS*:** What is the scope of the collection, or roughly speaking, the size?

***LJ*:** We have about 250,000 historic artifacts and natural resource specimens. We also have nearly 90,000 historic photos. In addition to the museum collection, we have the library and archives, including 8,000 linear feet of archives. We're the only park in the National Park System that is a National Archives and Records Administration repository, and they have standards that they hold us to for the storage and maintenance of those collections.

***YS*:** And this is currently located in approximately how large an area compared with what you need?

Members of the Lakota tribe engage in a prayer ceremony to bless a project to increase awareness about the bison issue, August 1997. NPS photo.

***LJ*:** We need between 40,000 and 70,000 square feet of space, because we are planning for 100-year growth in our new building. We have a large historic vehicle collection that should have more space so we can more easily access them. We have been promised $4.8 million in "line item" construction money in about fiscal year 2002, but we need $10–12 million to construct the size facility necessary for the long term.

***YS*:** Is the hope that you can put some of these things like the William Henry Jackson photographs or the vehicles on display? Or is that not appropriate?

***LJ*:** Our core mission for this building is collection storage. We don't have the staff to turn our collection storage repository into a working museum or even a visitor center. We will, however, try to show people working through glass walls, or perhaps use glass walls to display the vehicles. We'd like to have people be able to access them visually but not need a tour guide to accompany them. So it might be sort of a "virtual visitor experience."

***YS*:** The park has not had a full-time historian for some time. Is that position in the wish list? What other positions remain to be filled?

***LJ*:** I'd say the historian is a badly needed position. Lee Whittlesey functions as the *de facto* historian, although technically he is the archivist and that position brings more than enough work for one or even two people. We do have some money right now for oral histories, and Charissa Reid and Sally Plumb are filling that gap by doing some really important interviews with former biologists and park employees who worked in the natural resources program early on. Of course, Paul Schullery has filled another part of that program's need because of his long and active interest and expertise in the history of Yellowstone. He is continuing to work closely with Lee on research in that realm, although he is part-time and also working on other projects. The anthropologist position is temporarily filled by Rosemary Sucec. We have two-year money to fund that position. That program should be well addressed and will include the ethnographic resources inventory. She'll also handle the tribal consultation meetings,

and she'll do oral histories with tribal members.

***YS*:** Cultural resources and the whole evolution of appreciation of America's culture has grown along with Yellowstone National Park, hasn't it? Yellowstone was created because of the great wildlife and the geysers, and no one thought about cultural resources then. Do you feel as though public perceptions have changed to include the historic aspects of Yellowstone?

***LJ*:** Yes. Early park superintendent Philetus Norris, for instance, had a strong appreciation and interest in tribal uses of the park, which date back at least 10,000 years. He documented archeological sites, wickiups, and some interactions with tribal people who were here. A lot of the cultural resources have evolved as the park has grown. Structures were built during the development of the park, and because of their age, many are historic now.

***YS*:** And they're growing in public appreciation, aren't they?

***LJ*:** Exactly, yes. And the museum collections have grown. There were many research parties that came into the park in the 1800s and took collections to the Smithsonian or other major museums. Now we're trying to get a handle on where those collections are and what they consist of because they tell us a lot about the early history of Yellowstone. Those collections, primarily natural and some archeological, were recognized as important back then, they just weren't held here in the park. And with anthropology, there are well-documented cases of interactions with tribes early in the park's history, the most commonly known one being the flight of the Nez Perce in 1877.

***YS*:** With natural resources management, the Park Service has evolved into recognizing the natural processes and changes that are occurring. With cultural resources, is there recognition that these things are going to constantly change in ways that you can't even predict? Or how do you decide what period to preserve and present, for example, in Fort Yellowstone?

***LJ*:** We are actually wrestling with that one right now at Fort Yellowstone, because there are a couple of very important periods of development and you don't want to leave any of those out of a cultural landscape. You're right, that is a current issue, particularly for cultural landscapes. But for most cultural resources, you try to keep things in the best condition you can. The mitigating measure would be to document them as well as you can as soon as they're identified. That way, if there is loss or change, you've at least got the best condition documented.

***YS*:** There's a common perception that when a structure is historic, no changes can be made. But it really is not that simple, is it?

***LJ*:** No, in fact, we do recognize that there have to be some improvements made in buildings for safety reasons, livability, or to use modern techniques that might help preserve the building. That is all taken into consideration when we go through our compliance process. For instance, with safety, some improvements are negotiable and some are not. We work closely with the maintenance and safety staff to come up with a plan that will benefit everyone, including the users of the building, since quite a few function as offices or homes, while maintaining as much of the original fabric of the structure as possible.

***YS*:** Aren't there still thousands of years of work left to be done? Yellowstone is so vast; does it need systematic surveys across the backcountry for wickiups and archeologic sites?

***LJ*:** You're right, we probably would never hire all the staff we need to complete inventories, particularly archeological. Maybe 2 to 3 percent of the park has been inventoried for archeology and that has resulted in our finding about 1,000 sites. We have inventoried along the roads and that's often where the tribal people traveled prehistorically. We may be inventorying the highest use areas, but there probably will be a systematic method for inventorying within the park, particularly the backcountry. Along rivers or lakes, logical campsites for us would have been logical campsites for people prehistorically, too.

***YS*:** Particularly when we are still relatively sparse in terms of inventories and knowing what we have, can you comment on what you think some of the major threats are? We hear about, for example, vandalism of archeological sites or theft of important artifacts. Do you think we have any notion of the scale of that?

***LJ*:** Many of the threats to Yellowstone's archeological resources are natural. With spring runoff and erosion, we are losing sites along the rivers and even the lakeshore because of variations in the amounts of water. We have a very good working relationship with the rangers to monitor sites that are particularly vulnerable to vandalism and may be within access of the normal visitor use areas. One area that has been vandalized over the years is Obsidian Cliff. The base of that cliff has changed quite a bit even in the last 30 years. Former ranger Jerry Ryder used to comment that because of all the people taking away souvenir obsidian, the profile of the whole cliff has been affected.

***YS*:** What is the policy when a natural process threatens archeological sites? Say, for instance, if a wickiup is naturally about to collapse, or a fire threatens to burn it. Is the goal to preserve that site and prevent that natural decay or burning? Or is the hope to document it and let the process go on?

***LJ*:** We try to document the site as much as possible and retrieve as many artifacts from it as may help tell its story. Oftentimes our thrust is so much to identify the sites that we don't have time to fully research or excavate them. And we don't always need to, because you can get

"Maybe 2 to 3 percent of the park has been inventoried for archeology and that has resulted in our finding about 1,000 sites."

Wickiups, used as temporary hunting lodges, are evidence of Yellowstone's 10,000-year cultural history. NPS photo.

diagnostics that will help shorten the process. We do try to erect protective measures around sites if possible, and wickiups are particularly vulnerable. We have worked with the fire crew to reduce some of the fuel load around wickiups. Our biggest problems with wickiups, however, are that they are falling down. We are looking at ways to interpret those structures, perhaps by re-erecting one somewhere where more people could view it. The money we have gotten for this program has primarily been for inventories, and not so much for monitoring and protection, so that is still a vast need.

***YS*:** Isn't part of the challenge to try to document what we are doing today? So there will be an historic record 100 years from now and people will understand why we did what we did?

***LJ*:** Yes. Oral historians are going to love park newsletters like *Yellowstone Science* and *The Buffalo Chip*, particularly because they document those oral histories at the moment. It saves them from coming after us in a nursing home in 50 years. Those are good things we can be doing now and more proactive measures that will help people down the road.

***YS*:** Lee Whittlesey is often called the ferret of the files because he'll go around the buildings saying, "Don't throw that away! I'll look at that!" And especially with the electronic age coming up, there is some concern that so much record is getting lost.

***LJ*:** Yes, an interesting evolution of the cultural field is that we're working much more closely now with the computer folks. It's a very quickly evolving process that is forcing people who are very used to paper and objects into a high-tech field. We rely on the staff to help us by printing out email messages and filing them, and hopefully those will eventually go to the archives. Think if we were able to see Norris's email correspondence to his field rangers or to the headquarters back in Washington. It would be very interesting to read some of his thought processes.

***YS*:** Now you're going off to be a superintendent at two culturally based sites and you'll have responsibility that crosses all the divisions. How do you see some of the bigger challenges that go along with that?

***LJ*:** I really look forward to that diversity of operation. I experienced it briefly when I was acting superintendent at Bryce Canyon and really loved the variety of operations that I got to be involved in. I think Fort McHenry and Hampton are a little further along in identifying their resources than Yellowstone because they are so much smaller. There's a General Management Plan being prepared at Hampton right now and I'm very interested in seeing that through. I just welcome this opportunity to broaden my experience in different program areas.

***YS*:** What would you describe as your highlight here at Yellowstone?

***LJ*:** I'd say my highlight in general has been working with the American Indian tribes...I think we've made some really great strides toward improving communications and that has been very gratifying to see. Personally, another highlight would be hiking up Mount Hornaday last summer to look for paleontological specimens. It scared the heck out of me, but it was just spectacular once we got up there.

***YS*:** What do you think you'll miss about Yellowstone?

***LJ*:** I'll definitely miss the staff. I'll miss living in the park. I'm learning that is not very common back east and we were very lucky to be able to do that at Yellowstone. I'll definitely miss the variety of wildlife here, the wide open spaces, the clean air, the clean water—all the resources that Montana and Wyoming are so well known for. I think most of all though, I'll miss working with the program that I have gotten so deeply immersed in and gotten to know so well. I feel like I am just really beginning to know this place and now I am leaving.

***YS*:** Well you can still watch, albeit from a greater distance.

***LJ*:** The webcam!

***YS*:** We will miss you and we wish you luck.

***LJ*:** Thank you.

"Think if we were able to see Norris's email correspondence to his field rangers or to the headquarters back in Washington. It would be very interesting to read some of his thought processes."

Pilobolus: A Fungus that Grows in Yellowstone

by K. Michael Foos

After the information about Pilobolus *from a 1993 article in* Yellowstone Science *1(3)*[1] *was used as a basis for a May 2000 segment in the National Geographic Nature series "The Body Changers," it seemed appropriate to expand upon the description of this unique fungus.*

Pilobolus *(Figure 1) has been found throughout Yellowstone in association with a large number of animals including elk, bison, mule deer, pronghorn, moose, and bighorn sheep. It moves through the digestive tract of these and other animals and is excreted in their droppings that it subsequently helps to decompose.*

Figure 1. Photograph of Pilobolus *sporangial apparatus. Photo courtesy K. Michael Foos.*

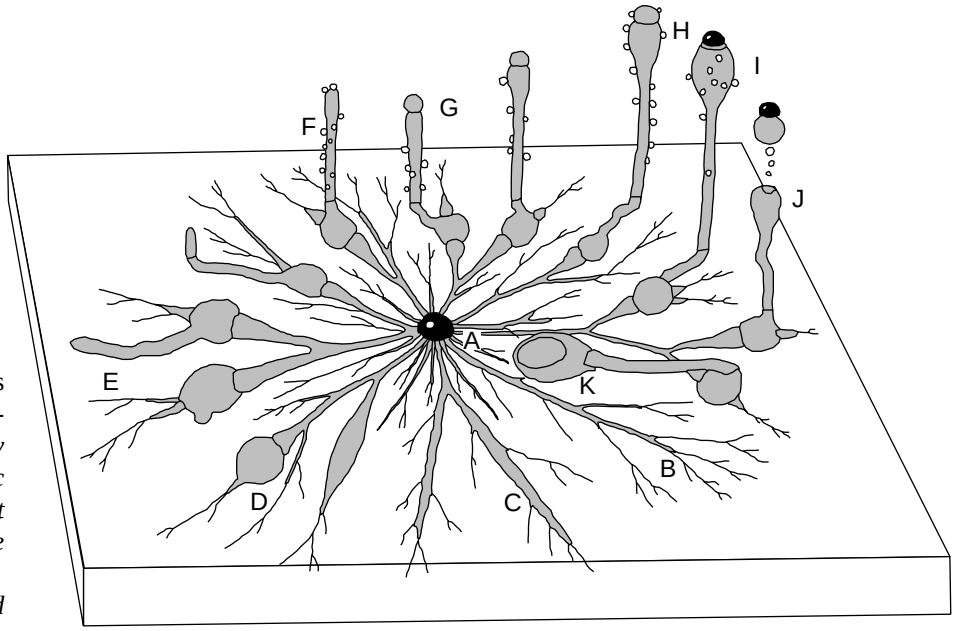


Figure 2 (A–K). Life cycle of Pilobolus. *A germinating sporangium is in the center with the various stages of the life cycle running clockwise beginning at the lower right of the diagram. Artwork courtesy K. Michael Foos, computer graphics by Tami Blackford.*

Life Cycle

The life cycle of this organism has been studied in some detail during the three centuries since it was originally described in 1688. In viewing the life cycle we usually begin with a viable sporangiospore (the asexual reproductive propagule) of *Pilobolus*. When sporangiospores (Figure 2 [A]) are located in a nutrient source such as dung, they swell and send forth germ tubes [B] that grow into mycelia, the filaments of which fungi are composed. Because the mycelia are submerged, they cannot be seen in natural media. However, when the organism is cultured on synthetic media in a laboratory, the mycelia can be seen as branching filaments without cross walls radiating out through the entire medium.

After three or four days of growth, depending upon species and various environmental conditions, the mycelium develops barrel-shaped swollen areas [C] either at the apex or within the mycelium. These swollen areas expand and become cytoplasmic-rich enlarged segments of the mycelium called trophocysts [D]. As the trophocysts mature they are separated from the rest of the mycelium by cell walls. Within a few days these trophocysts elongate and develop into greatly thickened mycelia that grow toward the light. These thickened mycelia [E], called sporangiophores, grow upward through the media and continue to elongate as they grow into the air.

After a few hours the sporangiophores stop elongating, and their terminal portions begin to enlarge [F]. As this terminal portion swells, a cell wall forms [G] separating the apex from the rest of the sporangiophore. This swollen apical area, called the sporangium, contains concentrated cytoplasm that will divide, producing tens of thousands of individual bi-

nucleate sporangiospores. The separating wall, called the columella, remains between the sporangium and the rest of the sporangiophore. Meanwhile, the subapical region of the sporangiophore continues to swell and produces a unique structure called the sub-sporangial swelling [H]. As the sporangium matures [I] it develops a black, water impermeable cell wall, and the sub-sporangial swelling ceases to increase in size. During the next few hours, as the sporangium continues to mature, its cell wall separates from the columella. As the sporangial wall separates from the columella, some gelatinous material from within the sporangium is exposed. Finally, the cell wall of the sub-sporangial swelling ruptures along the line of columella attachment and the pressure that is within the cell builds up and causes it to explode [J], much as a water balloon that has been smashed. As the end blows out of the cell it propels the sporangium several feet into the air. Subsequently, the recoil of the sporangiophore and its loss of cytoplasmic contents cause it to collapse [K].

A pressure of approximately 5.5 kilograms' force per centimeter squared develops within the sub-sporangial swelling because of a high concentration of dissolved substances, primarily phosphate and oxalate ions, and because of the elasticity of the cell wall. This is enough force to "shoot" a sporangium more than 2 meters vertically, or more than 2.5 meters horizontally in the direction of the light, depending upon the angle of the sun. The initial velocity with which sporangia are discharged has been calculated as between 5 and 28 meters per second.

If sporangia land on and adhere to grass or other herbage, they are in prime locations to be consumed by herbivores. If sporangia are consumed by an appropriate herbivore, they pass through the animal's digestive system and are deposited in feces. Within days, the sporangiospores within these sporangia begin to germinate and repeat the life cycle.

When maintained in culture (without benefit of the portion of the life cycle within the herbivore), most isolates of *Pilobolus* lose vigor after a few serial transfers, and in a relatively short time cease producing sporangia. Often, after several more transfers, they cease to grow altogether.

Elk droppings are germination sites for Pilobolus *sporangiospores. NPS photo.*

Special Characteristics of *Pilobolus*

Pilobolus has some special characteristics that one might not normally expect to find in a fungus:

A primary reason for studying* Pilobolus *collected from Yellowstone is to obtain isolates from an area that has been relatively undisturbed.

• Light affects the growth of *Pilobolus* in two very distinctly different ways. First, light is required to stimulate the development of asexual reproductive structures, beginning with the trophocyst and continuing through the development of the sporangium. While the details of this development vary between species, all species require light to develop normally. This makes their asexual reproduction highly photoperiodic. That is, sporangia develop in the morning after the development of the trophocyst on the previous day. Second, light has a phototropic effect on *Pilobolus* sporangiophores. It affects both the direction and rate of growth of sporangiophores. Then, the sporangial discharge, which is unique to the genus *Pilobolus*, is directly affected by light. The sub-sporangial swelling seems to act as a lens and directs light to an area in the sporangiophore that "aims" the tip of the sporangiophore toward the source of the light, prior to discharge. This particular aiming mechanism has been examined in some detail and it has been shown experimentally that virtually all sporangia shot from *Pilobolus* will hit a target in an arc of approximately 5 degrees.

• *Pilobolus* has an absolute requirement for chelated iron. That is, while most fungi can use iron in an inorganic form, *Pilobolus* must have the iron it needs in a complex organic molecule. The type of organic molecule that works best for *Pilobolus* is similar in shape to that of hemoglobin, an iron-containing molecule found in the blood of most higher animals. Several studies have identified this nutritional problem, and at least three different molecules have been found that can provide the iron required by these organisms. To date, no one has definitely determined the origin of the chelated iron used by these organisms in

their natural habitat. Interestingly, there are indications that the iron requirement may well be different in different species.

• Species of *Pilobolus* utilize sodium acetate as a carbon source and use nitrogen in the form of ammonium ions. Some species have a near absolute requirement for fatty acids. Unfortunately, much of the work on this aspect of *Pilobolus* nutrition died with Robert Page, who studied this organism in detail more than 30 years ago. Because we do not know the details of the nutritional requirements of these organisms, media containing dung are often used. No good synthetic medium has yet been developed that works consistently well with a large number of isolates of all species of *Pilobolus*.

• *Pilobolus* produces at least one pheromone. Of course, *Pilobolus* is not the only fungus to produce pheromones. Several fungi, and many other organisms, produce pheromones. There are even perfumes that claim to contain human pheromones. It has been shown that a pheromone produced by the mycelium of one mating type of *Pilobolus* stimulates the mycelium of a compatible mating type of *Pilobolus* to grow toward it. Thus, two compatible mycelia become oriented toward each other prior to cell fusion. Studies of the activity of pheromones in *Pilobolus* await discovery of the proper mating types and a suitable synthetic medium.

Subsequent work in Yellowstone has shown that the interaction of these same two organisms may also be a factor in the distribution of lungworm disease in the park's northern elk herd.

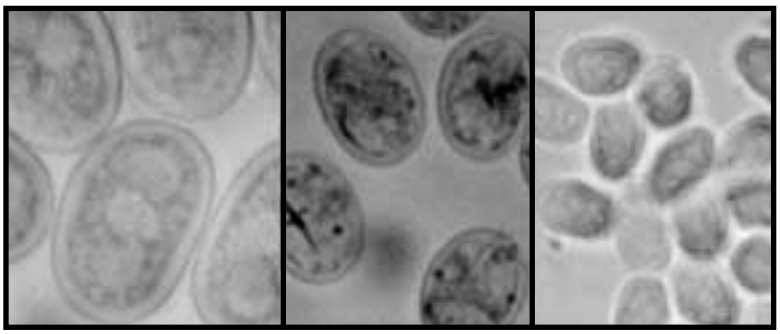


Figure 3. Photographs of magnified sporangiospores of Pilobolus kleinii *(left),* P. crystallinus *(center), and* P. roridus *(right). Photos courtesy K. Michael Foos.*

Pilobolus Systematics

For several years, I have been studying the taxonomy and the biogeography of *Pilobolus* to gain information about the diversity of this organism. A primary reason for studying *Pilobolus* collected from Yellowstone is to obtain isolates from an area that has been relatively undisturbed. Very few, if any, natural areas can absorb human invasion without habitat disruption. The Yellowstone ecosystem is one of the last remaining areas where biological specimens of all kinds can be found in an environment that might be called a "natural habitat." In the case of *Pilobolus,* I wanted to find isolates from animals that had not been transported from other ecosystems, had not been fed milled feed (perhaps containing antibiotics), and were not hybrids of individuals from different populations.

As the isolates of *Pilobolus* have been collected and identified, the usual taxonomic characteristics for this genus have been used. However, many of those characteristics have little value because they vary greatly. So, characteristics such as sporangial size, sporangiophore length, and trophocyst dimensions have been considered only superficially. However, characteristics such as spore size, shape, and coloration have been examined closely. These photographs of sporangiospores (Figure 3) from three species of *Pilobolus* are shown to provide a perspective of the relative sizes and shapes of these spores.

Two other characteristics that are included in original descriptions of species of *Pilobolus* and remain constant, but are often ignored in keys to species, are the sporangial attachment and shape of the columella. Published keys to the species of *Pilobolus* do not refer to the shape of the columella or sporangial attachment as distinguishing characteristics. However, after working with hundreds of isolates of these organisms, I have come to believe that these are valuable, highly consistent, and non-variable characteristics. Furthermore, they can be readily recognized because there is a correlation between the type of columella and the associated sporangial attachment.

Two types of sporangium attachment occur in species of *Pilobolus*. In the first, a distinctive groove is found between the sporangium and sub-sporangial swelling. The second type of attachment has no groove. Sporangia with grooved attachments have papillate columellae. Sporangia with non-grooved attachments have rounded columellae. Figure 4 shows both types of columellae and sporangial attachments of two species of *Pilobolus*.

Although taxonomic considerations are usually left to the taxonomists, this characteristic is so conspicuous that it begs to be mentioned in this description of the *Pilobolus*. Both of these species were isolated in Yellowstone and were cultured on synthetic media in a laboratory. After photographing the sporangial attachments, the sporangia were removed to show the columellae, while leaving the rest of the structure intact. If you look closely, you can see the groove around the sporangium to the right and below the papillate columella found under that sporangium. The sporangium on the left has no groove around it, and under that sporangium is a smoothly rounded columella.

Symbiosis

Nearly 40 years ago, a symbiotic interaction between *Pilobolus* and a round worm named *Dictyocaulus* was described. This interaction leads to the transmission of the larvae that cause lungworm disease in cattle. Subsequent work in Yellowstone has shown that the interaction of these same two organisms may also be a factor in the distribution of lungworm disease in the park's northern elk herd.[2]

Pilobolus and *D. viviparous* are both coprophilous, phototropic organisms that require passage through an herbivore's digestive tract for continuation of their life cycles. The infective larvae of *D. viviparous* develop in about the same length of time and under the same conditions as the sporangia of *Pilobolus*, and both have corresponding host ranges, habitats, and geographical distributions. The simultaneous appearance of numerous *D. viviparous* larvae and a proliferation of *Pilobolus* sporangiophores on the surface of dung point to their potential interaction.

This interaction of *Pilobolus* and *Dictyocaulus viviparous* has been described in the northern elk herd of Yellowstone.[3] The videotape, "The Body Changers" depicts infective larvae as they climb *Pilobolus* sporangiophores to the sporangium and shows how larvae move toward the moisture within the sporangium and migrate into the sporangium itself prior to sporangial discharge. Here, the larvae can travel within discharged *Pilobolus* sporangia and survive as the sporangium strikes a target. When on herbage, the *Pilobolus* sporangial wall protects not only its own spores, but the larvae as well, from desiccation and ultraviolet radiation.

Lungworm disease has been endemic in the northern elk herd for at least 40 years. The elk herd has grown during the time it has been infected, and can now be found in expansive regions of Yellowstone. As the elk have continued to carry and transfer these pathogens, they have maintained the disease for generation after generation. Having demonstrated that *Pilobolus* and *Dictyocaulus* larvae simultaneously reside within individual elk, we have made a strong case characterizing the role of *Pilobolus* in the transmission of the pathogen and as the primary agent for maintaining the current prevalence of lungworm disease in this elk herd.

So, while this fungus is small and inconspicuous, its presence in Yellowstone is felt by its effects not only as a decomposer, but also as an agent in the dissemination of the lungworm pathogen.

K. Michael Foos is a professor of biology at Indiana University East. He has included studies of Pilobolus *from the Yellowstone Ecosystem in his research program for the past 15 years. A major goal of this study is to compare fungi collected throughout the northern Rocky Mountains to determine whether the isolates collected that appear to be the same species have similar gene sequences. Simultaneously, he is able to photographically survey plants and animals within the Yellowstone Ecosystem for biology and photography classes. Photo courtesy K. Michael Foos.*

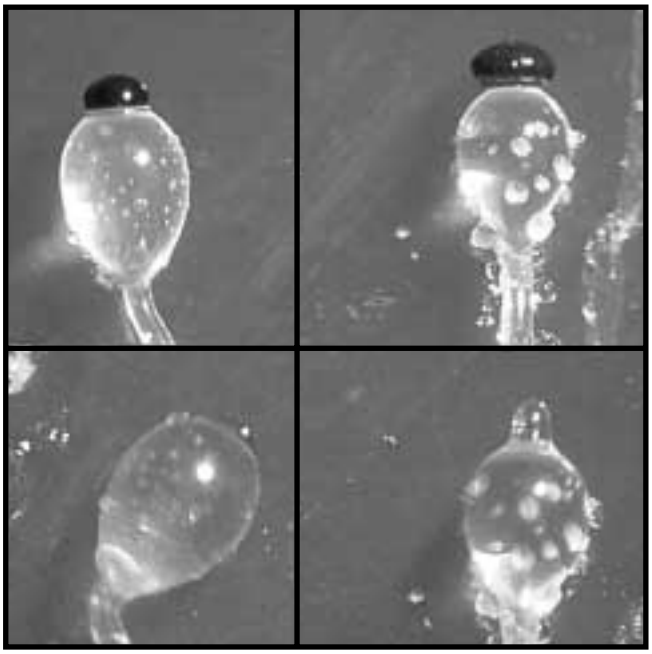


Figure 4. Photograph of two types of sporangial attachments (top) and two types of columellae (bottom). Photos courtesy K. Michael Foos.

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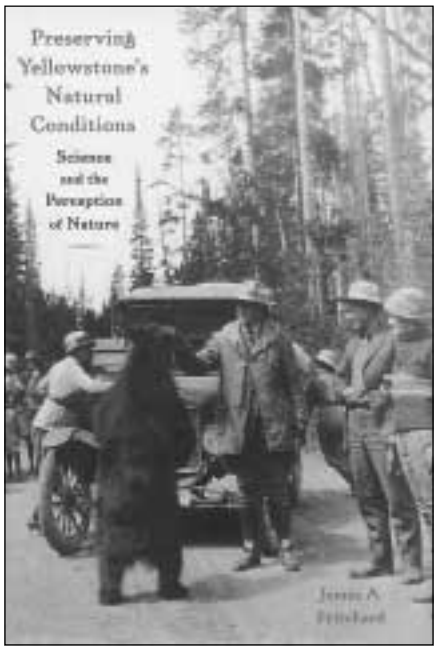
Preserving Yellowstone's Natural Conditions: Science and the Perception of Nature

by James Pritchard



Book review and essay by Paul Schullery

Lincoln: University of Nebraska Press, 1999. xix plus 370 pages, 37 black and white illustrations, two maps, endnotes, "essential sources" essay, index. $45.00 (Cloth).

I had best begin by admitting that, according to the book's acknowledgments (p. xi), "the original idea for the project" came from a conversation between the author and me. Pritchard's exceptionally careful consideration of the historical record in its many forms, as well as his extensive communication with dozens of other Yellowstone researchers and staff (many of whom, I am sure, were of much greater help to him than I was), relieve me of any significant responsibility or credit for what he says, but it seems fair to acknowledge my apparent part.

At least since 1933, when Carl Russell produced "A Concise History of Science and Scientific Investigations in Yellowstone National Park," many researchers, students, journalists, and others have written about the evolution of science and the perception of nature here. One would think that after so much had been said, there couldn't be all that much more to say. (One might especially think so if one was, like me, author of several books that deal with the topic.)

But in thinking such a thing, one would be wrong. *Preserving Yellowstone's Natural Conditions* is a grand achievement in part because it does so much to recast the entire experience of science and nature in Yellowstone, and in part because when it isn't taking the story in fresh directions it is probing more deeply into the old established directions.

Most people who are at all familiar with the recent historical scholarship of Yellowstone may know the outline of the story that this book tells. Yellowstone began in 1872 as a collection of geological and geothermal oddities. Animals and plants were not seen as a particularly significant local resource, and were given little more protection than they might receive on other public lands. But in the unpredictable political atmosphere of the Gilded Age, the park was an opportunity waiting to be taken. Early conservationists identified Yellowstone as a kind of theatre-of-the-last-stand for the rapidly disappearing big game of the American West. Under the determined championing of George Bird Grinnell, George Graham Vest, and others, the park soon evolved into an enormous wildlife reserve. Since the 1890s, ecological mysteries and controversies, rather than geological matters, have dominated the time of most managers and the attention of the public.

Over the long haul of the twentieth century, Yellowstone management policies have always reflected changing societal values: an evolving aesthetic of nature, greater tolerance for predators and fire, less tolerance for human influence in a "wild" setting, and a growing reliance on science as a tool for settling the park's endlessly thorny management quandaries. In all, the changes have tended to increase our desire to protect not merely nature's showpieces but nature's very being. For much of this century, though we may not have called any given policy "natural regulation" until quite recently, we have been slouching toward preserving not natural things, but natural conditions.

What Pritchard brings to this story is an appetite for the underlying scientific and political currents behind each development and an adventurous ability to identify the consequence of each event. He follows several interwoven threads in his narrative. There is the inevitable (but somehow more entertaining than usual) administrative history: how authority and power regularly emigrated within and beyond the National Park Service (NPS), and how those movements were affected by changes in the growing agency.

There is the exasperating tension between local and national interests, between those who, because they lived nearby, regarded themselves as dispro-

portionately entitled to decide how Yellowstone should be managed, and those who lived far away and at first hardly cared at all what happened in the park, but who have become progressively less willing to let the locals have their way.

There is, for nearly a century now, the amazingly important and thoroughly pervasive interest of the regional livestock industry in Yellowstone ungulate management, an interest that has resulted in intense political pressures to manage the park's wildlands in certain ways. Range management scholars, who traditionally functioned as the scientific arm of the stockgrower community, have had an almost incalculable influence on Yellowstone, and still do. Pritchard's recounting of this thread, alone, more than justifies the price of the book.

There is the growth of the wildlife management profession, with its own internal schisms and convolutions. Yellowstone has constituted almost as much of a philosophical reach for this profession as it has for the range management professionals. It will probably surprise you to see how far back the tension between wildlife biologists (*i.e.*, game managers) and Yellowstone's leadership actually goes.

There is the parallel growth of a scientific community with less allegiance to the goals and even the belief system of the game-management professionals. The rise of ecology and, later, of conservation biology as important disciplines with voices and ethical frameworks of their own is key to understanding why the professional wildlife management community has struggled so with Yellowstone issues.

There is the larger public conservation movement, with its changing constituencies and groups, its gradual awakening to the value of wilderness, and its maturing organizational bureaucracies that always have and always will find Yellowstone a bully pulpit, an irresistible moving target, and a perfect test case. Love-hate relationships never get more stormy than those between Yellowstone and its watchdogs.

And there is, weaving its way through these and other stories, a spectacular array of distinguished, strong-willed individuals—scientists, administrators, politicians, and others—who came along to give this or that administrative, philosophical, political, or scientific trajectory a nudge or a boot onto a new course. From the trophy-happy bowhunters who were allowed to "collect" grizzly bears for a California museum, to the park staff who crushed pelican eggs on the Molly Islands to save park trout for human anglers, this is a great, bewildering, and unforgettable saga, nothing less than the intellectual history of an important American institution.

At the center of this saga of science and human values, and the foremost hero of the book, is Charles C. Adams, a prominent early-twentieth-century ecologist. Harvard trained, a co-founder of the Ecological Society of America, and author of pioneering ecology texts, Adams is now largely forgotten or neglected by park historians. Pritchard argues persuasively that there is a direct line from Adams' fostering of both science and ecological integrity in national parks, through the works of George Wright in the 1930s and Starker Leopold in the 1960s, to the modern era. The role of predators in wild communities, the urgent need to resist exotic species introductions, the equally compelling need for complete, year-round habitats, and other subjects that we now regard as part of the "recent" wave of thinking in park management were thriving ideas and ideals, in Adams' circle at least, 80 years ago.

Here also, at last, is a full telling of the scientific and philosophical underpinnings of the Park Service's current "natural regulation" policy. A number of reporters and commentators have portrayed natural regulation as a hastily conceived brainchild of a few desperate Yellowstone administrators who, faced with overwhelming public disapproval of the elk herd reductions of the 1960s, needed a different policy and adopted natural regulation solely as a political expedient to get the heat off. This is essentially the tale as it is told in Richard Sellars' important historical book *Preserving Nature in the National Parks: A History* (1997). In Sellars' account of the wildlife controversies of Yellowstone of the 1960s and 1970s, bureaucracy over-rode science at every turn. As one complimentary reviewer (*Montana, The Magazine of Western History* 49[2]:78) wrote in summarizing the Sellars book, the NPS decided to adopt natural regulation for reasons that were "solely political, lacking a shred of scientific evidence."

Now, thanks to Pritchard's book, there is a good antidote to this regrettably oversimplified version of events. By reviewing the work and previous studies of Glen Cole, Douglas Houston, and other biologists of this key period, and by showing the influences of the greater scientific community's thinking on these Yellowstone researchers, Pritchard provides a contextual corrective for the popular but shallow view that this new policy was somehow "just politics." Pritchard shows where the ideas and science of natural regulation came from, and how they focused and congealed in the thinking of a few key individuals in the NPS in Yellowstone (for one example, Cole and Houston both worked in Grand Teton National Park immediately before coming to Yellowstone—Cole on the southern Yellowstone elk herd and Houston on Jackson Hole moose. While in the Tetons, both were already considering natural regulation in their studies, and were familiar with the literature on the subject).

In fact, after reading Pritchard's account, it appears to me that natural regulation policy, as hesitantly as it was offered to the world, as entwined as it indeed was in politics, and as incomplete as it may necessarily have been in its earliest formulation, was probably as well

Here also, at last, is a full telling of the scientific and philosophical underpinnings of the park service's current "natural regulation" policy.

grounded scientifically as any previous Yellowstone wildlife management policy had been at the time of *its* adoption. After all, the scientific criticisms of predator control, fire suppression, fish stocking, maximum sustained yield harvest of wildlife, and ungulate feeding have all increased dramatically in the scientific community since the 1960s. And since the natural regulation policy was launched, 30-odd years of inquiry, debate, and scrutiny have only increased the level of respect that a considerable element of the scientific community now has for the idea and the policy in Yellowstone (Yellowstone's 1960s leadership thought of natural regulation policy as something they were applying specifically to the ungulates, but eventually all natural resource management—bears, fish, fire, and so on—was widely perceived as part of a broad natural regulation policy).

But there is more to this long haul of scientific controversy than merely the potential vindication of a given policy. Had the Park Service in the late 1960s just continued its earlier course—of intensive manipulation of the Yellowstone setting—today's managers and public would be little better informed today than they were then about how this wildland actually functions. The scientific and educational gains of the policy seem to me to be extraordinary. Ecological understanding has advanced immensely because natural regulation has required such intense study. So, whether one regards natural regulation policy to have originated solely from political necessity, from some lucky intuitions on the part of a few bright scientists, or from some combination of politics, evolving scientific theory, and the energy and vision of a few people in the right places, it is getting harder and harder to argue that it was a bad idea in the first place.

Among the many other threads Pritchard follows there is one that he has highlighted perhaps without intending to—a remarkable disjunct in our received wisdom about the NPS. That wisdom has long upheld Horace Albright as the great "wilderness defender" who championed the cause of the parks against considerable odds and won so many battles on their behalf. All that is true; Albright's achievements were indeed heroic, and

Horace Albright, former Yellowstone superintendent, was instrumental in creating many of the park's early wildlife policies. NPS photo.

some were the result of individual fortitude almost beyond imagining. But when viewed through the eyes of the environmental historian, a different Albright emerges. Again and again, when changing scientific understanding suggested that it was time for policy to adjust, Albright almost invariably led the resistance. Predator control, natural fire, natural regulation—Albright was always on the side of the status quo and against the adventurism of trying new things. Perhaps it will take another historian, perhaps after another generation has passed, to give us a more complete and probing portrait of this most complex of conservation heroes.

That I regard the book as indispensable does not mean I agree with everything in it. Here and there are errors of fact or interpretation. In his discussion of the fires of 1988, Pritchard seems to believe that NPS delays in fighting the fires allowed the wind to create "fires of monumental extent" that could not then be put out when firefighters finally tried (p. 286). This was certainly a fashionable view at the time, but it is untrue. All fires were declared "wildfires" (meaning that they were judged to be out of prescription and therefore to be suppressed—the terminology of wildland fire isn't used correctly in the book) when a modest total of about 17,000 acres was contained within fire perimeters. From that time until the final total of about 800,000 acres was included in the fire perimeters, firefighting was continuous and aggressive. The North Fork Fire, for example, which accounted for about half the total acreage affected, was fought from within about an hour of its start.

Toward the end of the book Pritchard confidently asserts that, "the 1980s spelled the demise of single-species thinking in terms of managing Yellowstone's wilderness" (p. 306). I know what he's getting at: that greater-Yellowstone managers became more inclined to think in ecosystem terms. But the demise of single-species thinking is hardly what has happened. Instead, we now are more consciously managing single species toward ecosystem goals. The existing legal and bureaucratic tools give us little choice. If the distinction is not clear, consider how often the Endangered Species Act must be invoked (Save the grizzly bear!) to achieve some ecosystem-management end (Stop unplanned suburban sprawl!). American society, through its laws and public opinions, still cherishes some species much more than it cherishes others. Until that changes, ecosystem management will be practiced through this peculiar device of using the rare and adored as a tool to protect the rest.

Sad to say, it is already clear that this book will not be widely enough read. I do not think that even one regional publication, including newspapers that devote vast amounts of attention to Yellowstone issues (and to far less deserving books), has noted it, much less given it the kind of fulsome review it deserves. Anyone seeking to be informed about Yellowstone's complex ecological issues is terribly disadvantaged by not having read this book. Not reading it promotes just the kind of multi-generational ignorance and confusion that the book so carefully and sympathetically describes for us as having impeded better management of Yellowstone in the past.

Paul Schullery, former editor of Yellowstone Science, *is the author of* Searching for Yellowstone: Ecology and Wonder in the Last Wilderness *(1997) and other books about the park and conservation.*

Lynx Survey to Begin in YNP

The wildlife team at the Yellowstone Center for Resources (YCR) is initiating a three-year effort to document the presence and distribution of lynx in Yellowstone National Park. Principal investigators are biologists Kerry Murphy, Kerry Gunther, and Jim Halfpenny (*A Naturalist's World*, Gardiner, Montana). A YCR wildlife technician, a volunteer, and District Resource Management Coordinators will also work on the survey.

Field personnel will document lynx during winters by snowtracking on the ground and from airplanes, and during summers by using hair-snares and DNA-based species identification techniques. Training and field work begin during January 2001. Contact Kerry Murphy at (307) 344-2240 for more information.

Park Wins Auction for Rare Item

The original Yellowstone Park Transportation Company ledger of stagecoach operations in the park, 1892–1906, has just been purchased for addition to the park archives. Thanks to the magic of Internet auctions and friends of Yellowstone, this item is now available for use in the research library, located in the basement of the Albright Visitor Center.

Interior Secretary Visits Yellowstone

Interior Secretary Bruce Babbitt made one last official stop in Yellowstone National Park on January 13 to receive a briefing on the park's successful wolf reintroduction. The park held a press conference in the morning and then visited Lamar Valley, where the group observed wolves and even a grizzly bear stirring from hibernation. Secretary Babbitt presided over the release of 14 Canadian gray wolves in 1995. Today, over 120 wolves inhabit the park.

New Publications Available

Yellowstone in the Afterglow: Lessons from the Fires is now available from the YCR. The report was written by park volunteer and seasonal writer Mary Ann Franke. It is based on readings of published and unpublished research (mostly since 1988) on the effects of Yellowstone's wildland fires and on discussions with many of the participating scientists. It will soon be available online.

The *1999 Investigators' Annual Report* is also available. It can be found on Yellowstone's website at *www.nps.gov/yell/publications*. This report represents a summary of all the research done in Yellowstone during 1999.

The long awaited *Greater Yellowstone Predators: Ecology and Conservation in a Changing Landscape*, proceedings of the Third Biennial Conference on the Greater Yellowstone Ecosystem, has just arrived in print. These proceedings offer a glimpse of the rich history of Yellowstone predators and cover a surprising number of species including ravens, salamanders, and spotted frogs, in addition to medium and large carnivores.

If you would like a copy of any of these publications, please contact Tami Blackford at (307) 344-2204 or Tami_Blackford@nps.gov.

Winter Use Decision Announced

Protecting visitor safety and enjoyment, air quality, wildlife, and the natural quiet of Yellowstone and Grand Teton national parks were the determining factors in a decision to phase out most snowmobile use in the two parks over three years in favor of multi-passenger snowcoaches.

The Record of Decision, published in November 2000, followed many years of study to determine what kinds of winter activities were appropriate for Yellowstone and Grand Teton national parks and the John D. Rockefeller, Jr., Memorial Parkway. A final rule required to implement portions of the Record of Decision was finalized and published in the Federal Register on January 22, 2001. Winter use planning started as far back as 1993.

A snowcoach in the park. NPS photo.

The decision concludes that snowmobile use in these parks so adversely affects air quality, wildlife, natural soundscapes, and the enjoyment of other visitors that the resources and values of these parks are impaired, creating a situation which conflicts with the mandate of the NPS Organic Act that parks be left "unimpaired for the enjoyment of future generations." Executive Orders issued by Presidents Nixon and Carter and the NPS's own regulation on snowmobiling prohibit snowmobile use in national parks where it disturbs wildlife, damages park resources, or is inconsistent with the park's natural, cultural, scenic, and aesthetic values; safety considerations; or management objectives.

Effective the winter of 2003–2004 and thereafter, the Record of Decision allows oversnow motorized recreation access via NPS-managed snowcoach only, with limited exceptions for continued snowmobile access to other public and private lands adjacent to or within Grand Teton National Park. Until then, interim actions would progressively reduce the impacts from snowmobile use in the parks.

Specifics of the plan are as follows:

DURING THE WINTER OF 2000–2001:

- There is no cap on snowmobile use.
- Oversnow motorized travel is prohibited from 11 P.M. to 6 A.M., except by authorization, beginning December 18, 2000.

DURING THE WINTER OF 2001–2002:

- Existing commercial snowcoach operators would be allowed to increase their fleet size and encourage snowmobile rental businesses and other new operators to purchase or lease snowcoaches and reduce snowmobile numbers.
- Daily snowmobile use numbers would be set for all three park units at levels not to exceed the seven-year average for peak days.
- For snowplane use on Jackson Lake, permits would be reissued to permit holders of record. No

new permits would be issued.
- Oversnow motorized travel would be prohibited from 9 P.M. to 8 A.M., except by authorization.

DURING THE WINTER OF 2002–2003:
- Existing commercial snowcoach operators would be allowed to continue to increase their fleet size and encourage snowmobile rental businesses and other new operators to purchase or lease snowcoaches and reduce snowmobile numbers.
- Daily snowmobile use numbers would be set for all three parks at levels that are expected to lead to an approximately 50 percent reduction in snowmobiles entering Yellowstone's South and West entrances.
- Current snowmobile use levels would be allowed to continue at the East and North entrances, on the parkway's Grassy Lake Road, and on the Continental Divide Snowmobile Trail in Grand Teton NP and the parkway.
- Snowmobiles in Yellowstone must be accompanied by an NPS-permitted guide and travel in groups of no more than 11.
- In Grand Teton NP and the John D. Rockefeller, Jr., Memorial Parkway, the superintendent would be authorized to require groups and guides.
- Oversnow motorized travel would be prohibited from 9 P.M. to 8 A.M., except by authorization.
- Snowmobile use would be eliminated within Grand Teton NP except on the Continental Divide Snowmobile Trail and on access routes leading to private lands and adjacent national forest lands.
- Snowplane use, as well as snowmobile use, would be discontinued on the frozen surface of Jackson Lake in Grand Teton NP.

In 2003–2004 and thereafter, most oversnow motorized visitor travel in the three park units would be by NPS-managed snowcoach only.

The Record of Decision is available online at *www.nps.gov/planning*.

Thanksgiving Rumblings

Yellowstone's geologic forces were hard at work on Thursday, November 23. An earthquake of 4.2 magnitude occurred in the park at 9:20 P.M. The epicenter of the shock was located about one mile north of Norris Junction, an area that is noted for earthquake swarms. The earthquake was felt at Madison Junction and at Mammoth Hot Springs, where no damage was reported. In 1975, this area experienced a magnitude 5.9 event that did cause damage. No obvious changes in thermal activity were observed at the Norris and Old Faithful areas as a result of the earthquake.

Yellowstone National Park and other GYE residents can help develop a new online Yellowstone earthquake database by answering a simple online questionnaire if they feel ground motion accompanying earthquakes in and around Yellowstone National Park. The questionnaire can be found online at *http://pasadena.wr.usgs.gov/shake/imw/STORE/Xjjai/ciim_display.html*.

Bison Decision Reached

The National Park Service and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service and Forest Service came to a final agreement on a joint management plan for bison in Yellowstone National Park and the state of Montana. The plan is designed to preserve the largest wild, free-ranging population of bison in the United States, while minimizing the risk of brucellosis disease transmission (between bison and cattle) to protect the economic interest and viability of the livestock industry in Montana. By allowing bison the opportunity to seek critical winter range outside the park, the plan reflects a commitment on the part of the agencies to end the unnecessary killing of bison outside Yellowstone National Park. It is the result of over eight years of negotiation and seven months of mediation between the federal agencies and the state of Montana. A copy of the Record of Decision is available online at *www.nps.gov/planning*.

"Obsidian Pool" is Official

The NPS Office of Policy in Washington, D.C., reports that the U.S. Board on Geographic Names officially approved the name Obsidian Pool for a backcountry feature in the Mud Volcano area on November 9, 2000.

Obsidian Pool. NPS photo.

Your Picture May Be Worth 1,000 Words—And a Trip to a National Park

Remember that great picture you took at a national park last summer? Everyone said it should win a prize—and now it can! The first National Parks Pass Experience Your America Photo Contest has been announced to select the image for the 2002 National Parks Pass. The contest is sponsored by the National Park Service and the National Park Foundation with Kodak, a Proud Partner of America's National Parks.

Any photo taken by an amateur photographer in a national park since January 1, 2000, is eligible. The winning image will appear on the 2002 National Parks Pass. The photographer submitting the winning image will get a trip for four to any national park, a Kodak camera kit, and a personalized National Parks Pass.

Complete contest rules and an entry form are available online at *www.nationalparks.org* or by sending a self-addressed stamped envelope to: National Parks Pass Photo Contest Rules, P.O. Box 5220, Young America, Minnesota 55558-5220. Entries are due by March 15, 2001. National Park Service, National Park Foundation, or Kodak employees and their immediate family members are not eligible to enter.