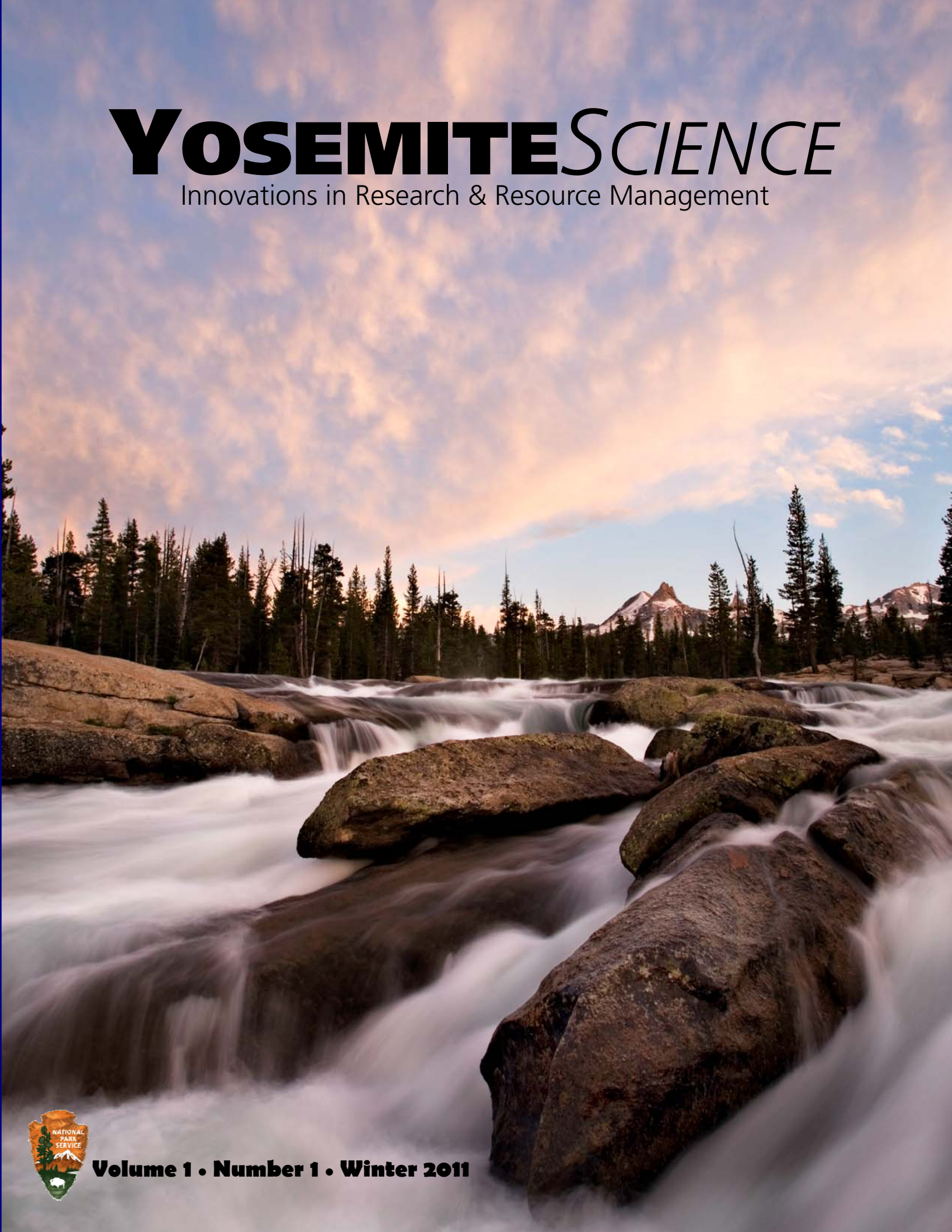
YOSEMITE SCIENCE

Innovations in Research & Resource Management



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YOSEMITE*Science*
Innovations in Research & Resource Management

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Superintendent
Don L. Neubacher

Chief, Resources Management and Science
Niki Stephanie Nicholas, Ph.D.

Editor
Henrietta DeGroot

Assistant Editor
Brenda Ostrom

Copy Editors, Layout and Design
Karen Dera
Carol Knipper
Elizabeth Munding

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Submissions are welcome from all investigators conducting formal research in Yosemite and the broader Sierra Nevada area. To submit article proposals or to send a letter to the editor, please write to the following address:

Editor, *Yosemite Science,* P.O. Box 700,
El Portal, CA 95318

You may also send an email to:
yosemite_science@nps.gov

www.yosemitescience.org

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Learn more about Yosemite's natural and cultural history on the park's website: www.nps.gov/yose.

On the Cover

Tuolumne Cascades with Cathedral Peak in the background.
See related story on page10.

Photo by John D. Sun

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Science-based Decision Making

I am pleased to present the first issue of *Yosemite Science*. Park scientists and research collaborators are doing exciting work, and we are thrilled to have this opportunity to share some of their progress. In this issue, we highlight work from the Resources Management and Science's six branches: Physical Science & Landscape Ecology; Wildlife Management; Vegetation & Ecological Restoration; Visitor Use & Social Sciences; History, Architecture & Landscapes; and Anthropology. Stories include visitor-use research on a Class IV climbing route; the recent discovery and documentation of a new Yosemite plant species; and the peregrine falcon recovery effort.

Science is a powerful tool in resource management, but it is not a crystal ball. It doesn't always provide definite answers to make our job of managing park resources easier. What science does, however, is provide the background, context, and tools for us to ask better and more relevant questions, so we can continue to refine park management. It is this continual evolution and learning process that makes science so powerful and exciting.

Although we often must act in the face of uncertainty, we continually adapt our processes as new and better information is available. We know that when scientific information is widely shared, it creates opportunities to connect the best ideas in sound science to the best solutions for managing resources. Yosemite has long had a history of doing just that.

In the 1920s, park managers implemented an innovate approach to wildlife management. In an effort to protect black bears in the park, feeding areas were established to discourage bears from wandering into developed areas where they could present a danger to visitors. Now we know that it is important to bears' survival to forage in the wild and maintain their ability to find their own food sources. It is easy to say, in hindsight, that feeding bears was a bad idea, but at the time, it offered a significant measure of protection over other management strategies being employed—namely killing large numbers of bears. While black bears disappeared from many areas in the Western landscape, they remain in Yosemite.

One hundred years ago, we thought that the best way to protect our giant sequoias was to keep them from burning. Now we know that fire is a critical component in the growth cycle by providing the optimal soil condition that enables seeds to germinate, along with ensuring the space for the trees to survive.

Niki Nicholas conducts a fish survey using line and tackle and visual surveys at Yosemite National Park's Granite Lakes to determine species present. Brook trout (*Salvelinus fontinalis*) was the only species observed or caught during this 2008 survey.

As our understanding of bears, sequoias, and other natural and cultural resources continue to improve, so do our efforts and methods to protect them. It is the striving, the stumbling, and the dedication to science that makes Yosemite a leader in resource protection. Through inspiration, perspiration, and communication, we continue to arrive at ever better solutions. Each issue of *Yosemite Science* will share with you with our innovations and insights into how we continue to use the best available information to protect Yosemite's natural and cultural resource treasures.

Niki Stephanie Nicholas, Ph.D.

Chief, Resources Management and Science

High-resolution Imaging Tools for Understanding Geologic Processes

By Greg Stock, Ph.D.

Yosemite Valley's impressive granite cliffs, while stunningly beautiful, also present potentially serious hazards to park visitors, employees, and residents. Since 1857, over 700 rock fall events have been documented in Yosemite Valley, with fifteen associated fatalities and numerous injuries. Park planning efforts require information on geologic hazards, but until recently, monitoring rock-fall activity was very difficult due to the sheer scale of Yosemite Valley. Geologists typically would gather geologic data of rock faces by climbing them or by viewing them with a spotting scope or from a helicopter. These techniques posed obvious dangers but also provided only limited data. However, thanks to super-high resolution gigapixel images and digital maps produced by laser scanning, we now have unprecedented access to the geological features of one of the world's most famous parks on a laptop computer.

The new imagery was produced using a combination of laser scanning and digital photography. LiDAR (Light Detection and Ranging) is a relatively new mapping technique that utilizes laser scanning of the land surface to produce very high-resolution digital topographic maps. The laser scanner can be placed either in an airplane, yielding a bird's-eye view of the landscape, or mounted on a tripod on the ground surface and aimed up at the cliffs (Figure 1). We have utilized both techniques in Yosemite, and integrated the results to provide full three-dimensional representation of Yosemite Valley's complex morphology. The resulting images are useful for mapping previous rock falls and simulating potential future rock falls, but the real value of the technique comes from repeating scans through time.

Figure 1. Ground-based laser scanner collecting digital topographic data for the southeast face of El Capitan, site of several large rock falls in 2010.

By comparing scans of cliff faces before and after rock falls, we can precisely determine the rock fall location, volume, and pre-failure geometery. We can also analyze the geologic structure that contributed to the failure, and use this information to assess the hazard of similar areas. With baseline LiDAR data for most of Yosemite Valley already in place, it is possible to quickly rescan a cliff after a rock fall to analyze that event in high resolution.

In collaboration with scientists from the U.S. Geological Survey, we have now documented many rock falls in Yosemite Valley using repeat LiDAR, including the October 2008 Glacier Point rock fall (Figure 2) and more recent rock falls near Half Dome and the Royal Arches.

In addition to laser scanning, new advancements in high-resolution digital photography allow for photo-documenting the walls of Yosemite Valley in unprecedented detail. As part of The Yosemite Extreme Panoramic Imaging Project, a collaborative project between the National Park Service and Los Angeles-based photographers from xRez Studio, gigapixel panoramic photographs were captured for all of the major cliff faces in Yosemite Valley. A primary goal of this project was to produce high-resolution baseline imagery of Yosemite Valley's cliffs to aid geologists in documenting and understanding the frequent rock falls in Yosemite Valley.

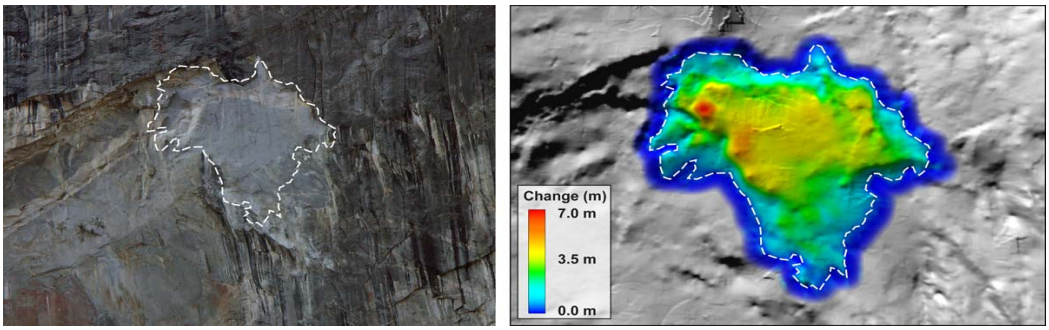

Figure 2. Photograph showing the source area for the October 2008 Glacier Point rock fall (left) and repeat LiDAR analysis showing amount of change between pre- and post-rock fall scans (right). The total volume of this rock fall is calculated to be 5663 ± 36 cubic meters.

On a single day in May 2008, photographic teams positioned themselves on the landscape to shoot images simultaneously to ensure uni-

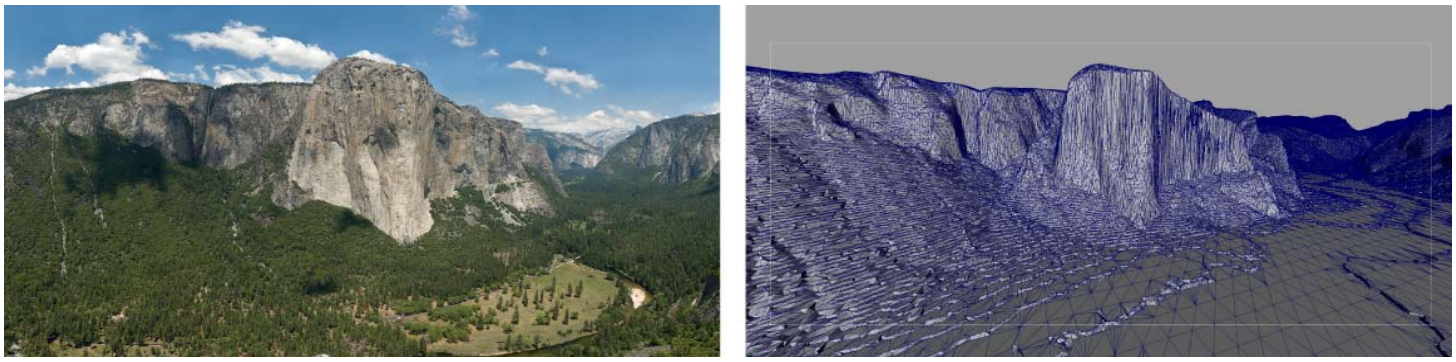

Figure 3. High-resolution gigapixel photograph of the southwest face of El Capitan (left), and the corresponding LiDAR-based digital topographic map of the area (right). Projecting the photography onto the LiDAR data yields a full three-dimensional rendering of this predominantly vertical terrain.

Figure 4. Orthorectified panoramic image of the north wall of Yosemite Valley, produced by merging several individual panoramic images and projecting them onto LiDAR-based digital topography.

form lighting. Each team produced 500 overlapping shots from a single vantage point, and these images were assembled into 20 high-resolution panoramas. These panoramas were then projected onto a one-meter resolution digital terrain model produced from airborne LiDAR data in 3-D rendering software (Figure 3). This graphic process unified Yosemite Valley's walls into an orthorectified view, yielding perspectives of large areas of Yosemite Valley (Figure 4). Printed out at magazine-quality 300 dpi resolution, the merged photos stretch uninterrupted for 40 feet.

As with the LiDAR data, the gigapixel photographs have proven very useful for documenting rock fall events. Numerous rock falls have been bracketed by before and after photographs, revealing important details about the nature of these failures. In addition, repeat high-resolution photography has documented rock falls that had previously been unrecognized (Figure 5).

While rock falls have been documented in Yosemite for over 150 years, these new high-resolution imaging tools provide opportunities for documentation and analysis never before possible. It is now possible to immediately repeat imaging after a rock fall to quantify that event precisely and make effective science-based management decisions. The techniques being pioneered in Yosemite are already proving valuable for park planning efforts that require information on the stability of cliffs and the extent of future rock-fall runout zones. In conjunction with other rock fall investigation methods, such as field mapping and instrumentation, park staff are developing a comprehensive set of tools for furthering our understanding of this complex and potentially dangerous process. In the long-term, it's possible that these imaging tools could help geologists forecast when rock falls are likely to occur. Although predicting rock falls is not yet possible, documenting and understanding the events that happen is an important step toward this goal. ▪

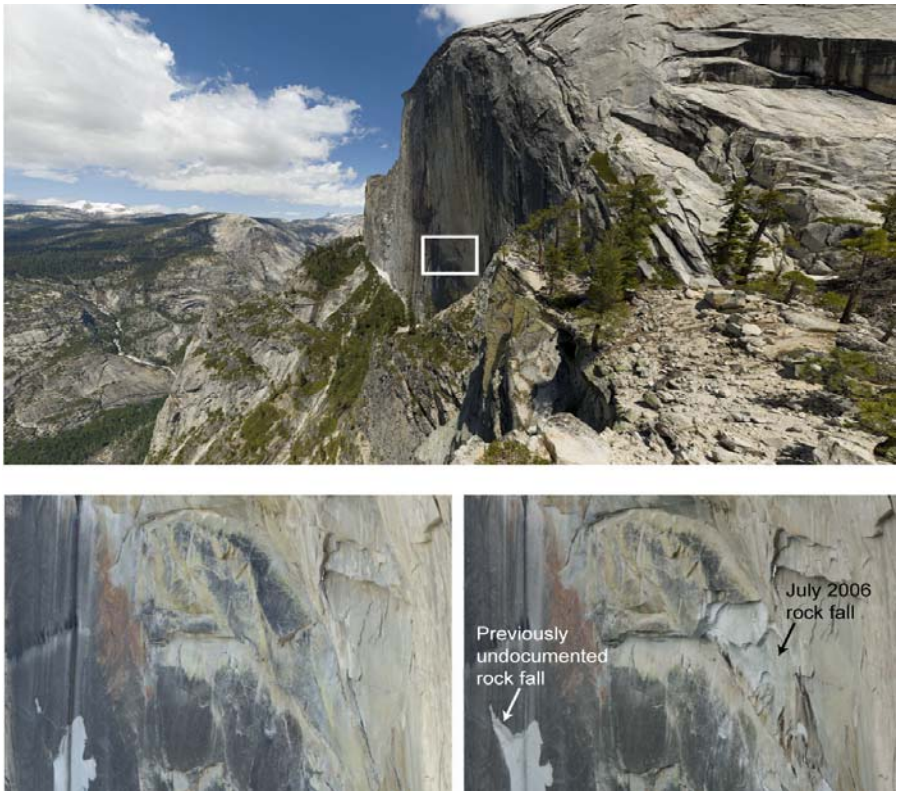

Figure 5. Gigapixel panoramic photograph of the northwest face of Half Dome from the Diving Board (top), white rectangle shows location of lower views of the face prior to (left) and after (right) rock falls occurring between 2005 and 2006.

Peregrine Falcon Recovery

By Sarah Stock

In November of 2009, the peregrine falcon (*Falco peregrinus*) was delisted from the California threatened and endangered species list, 10 years after it was removed from the federal endangered list. This striking recovery in the Yosemite area and throughout most of the world is due in large measure to the ban on the use of DDT (Dichloro-diphenyl-trichloroethane).

Beginning in 2009, through funding from the Yosemite Conservancy, Yosemite initiated a park-wide peregrine falcon breeding survey (the first since 1995), which will continue into 2011. This project documents the success story of peregrine falcon recovery in Yosemite National Park.

Knowing the locations and breeding status of historic and current eyrie (nest) locations is essential for implementing protection measures, such as minimizing disturbance from rock climbing and other recreational activities, and from aircraft during park flight operations. Findings from the surveys continue to inform wildlife management and wilderness protection to ensure protection of the recovering peregrine falcon.

Results from the surveys have confirmed an increase in the park's peregrine falcon population and indicated significant progress in recovery of the species. Throughout the park from March-August 2010, park staff detected presence of peregrine falcons at 16 cliff sites. Repeated behavioral observations at these locations revealed 10 pairs, including nine breeding pairs that collectively fledged 17 young. In 2010, the record for the number of active eyries increased to eight, one up from the previous year's total of seven eyries. The most exciting discovery was the re-occupation of the historic "North America Wall" eyrie on El Capitan, where peregrine falcons were discovered nesting in 1978 after a 37 year absence. Another highlight occurred at Hetch Hetchy where one pair produced four fledglings, the largest number of young ever recorded from one nest in Yosemite. Overall, these findings represent a more than two-fold increase in the peregrine's population size in Yosemite since the last time that park-wide surveys were conducted in 1995. The 2010 surveys also revealed insights into other nesting birds of prey. Three active Golden Eagle nests, one Osprey nest, and one Bald Eagle Nest were discovered and documented.

Yosemite National Park began a peregrine falcon breeding survey in 2009 that will continue into 2011.

Also in 2010, park staff monitored behavioral responses of breeding peregrine falcons to helicopter activity within the vicinity of their eyrie sites. Along with climbing route closures, airspace closures are also established beginning March 1 to protect breeding pairs of peregrine falcons. Disturbances to nesting peregrine falcons can result in nest failure if adults are flushed from the area for long periods of time, making the young susceptible to predation and temperature extremes.

Study results will be used to make recommendations to park management on how to reduce any potential disturbances at known breeding sites. Recommendations may include revised seasonal climbing closures established in the Superintendent's Compendium, and revised restrictions on aircraft use in the vicinity of active peregrine sites. Peregrine data from Yosemite will also be provided to the California Department of Fish and Game and the U.S. Fish and Wildlife Service to contribute to state and national monitoring efforts of this recovering, high-profile species. By 2012, a comprehensive report of all past Yosemite peregrine data and reports will be compiled to assess the long-term population trend and address ecological factors that are important for promoting a healthy peregrine population into the future. ▪

Yosemite Bog-orchid: A Long Journey to Discovery

By Alison Colwell, Ph.D., & Peggy Moore

On a summer morning in 2003, two biologists hiked into a remote meadow south of Yosemite Valley to do a botanical survey and found an unknown species of orchid. This particular orchid species had been growing in this and surrounding meadows for tens of thousands of years. It likely survived at least one glacial event, safe in its ancient boggy meadow habitat while the glaciers that carved Yosemite Valley wound their way around its montane redoubt. The orchid kept company with several other species of meadow wildflowers that are also known only from the central Sierra Nevada in and around Yosemite National Park. One of these, the rare Bolander's clover (*Trifolium bolanderi*), was what had brought the two U.S. Geological Survey biologists, Charlotte Coulter and Alison Colwell, into the meadow in the first place. This event set in motion the final phase in the long journey between the original discovery of the orchid and its official recognition as the Yosemite bog-orchid, *Platanthera yosemitensis*. The story illustrates both the history and the future of botanical exploration in the Yosemite region.

In 2003,the Yosemite bog-orchid was discovered in Yosemite National Park's botanically-rich meadows. This orchid is the only known orchid species endemic to California's Sierra Nevada range.

The journey first started with a Claremont schoolteacher, George Henry Grinnell, who had an abiding passion for orchid and stamp collecting. Grinnell spent his summers roaming California in search of native orchids. The specimens he collected on his trips reside largely at the Rancho Santa Ana Botanical Garden in Pasadena. In 1923, Grinnell visited Yosemite and made several plant collections in the park (in those days it was legal to do so), including two specimens of an orchid that he labeled *Habenaria hyperborea*. Grinnell apparently did not realize that he had collected something unique, so the two specimens spent the next seven decades filed in a folder with other collections that they did not entirely match, waiting for the state of knowledge of bog-orchids to gradually improve.

The wait was long, but not in vain, for in 1993, Ron Coleman and Leon Glicenstein, doing research for Coleman's book *The Wild Orchids of California* inspected the collections at Rancho Santa Ana. By this time, many more bog-orchid specimens had been collected and several western United States species had been described. Coleman and Glicenstein looked closely at Grinnell's specimens, compared them to the dozens of other California specimens and saw that Grinnell's were distinct. Excited by what they had seen, they departed for Yosemite to try to find the orchid. Despite Grinnell's somewhat vague description of the collection location, they were able to locate a small group of plants. They sent a flower sample to the current expert on bog-orchids, Dr. Charles Sheviak of the New York Museum in Albany, to confirm the identity of their find. Sheviak found the flowers to be unlike any known in California, but very similar to a species from the southwestern United States, purple bog-orchid (*Platanthera purpurascens*), so he assigned that name. The plant appears in Coleman's book under the synonym *P. hyperborea* var. *purpurascens*.

George Henry Grinnell collected a Yosemite bog-orchid specimen from Yosemite National Park in1923. Its relationship to other bog-orchids remained misunderstood for 70 years.

The next clue to the new bog-orchid came from an ambitious botanical project, the *Flora of North America*. Eventually to comprise 30 volumes, this massive and largely volunteer effort seeks to definitively describe every plant species described in the United States and Canada. Dr. Sheviak, as the author of the chapter on bog-orchids, condensed his expertise into a series of detailed descriptions, complete with a range map and illustrations. On the range map, Sheviak placed a dot to represent the *Plathanthera purpurascens* in Yosemite; but following a review of the volume, Dr. Dean Taylor, an expert on the flora of the central Sierra Nevada, noted the anomalous east-west disjunct nature of this occurrence.

Meanwhile, in 2003, with support from the National Park Service Inventory and Monitoring Program, the park, in partnership with the U.S. Geological Survey, embarked on an effort to determine the status of Yosemite's rare plants. With the benefit of the Sheviak description, biologists were on the lookout for the anomalous orchid. Thanks to the clues gathered over previous decades, the plant was recognized in the field a few months later.

A complete botanical specimen was made of the find in July 2003 and sent to Sheviak. He found that the leaves did not match those of *Platanthera purpurascens* and agreed that it was possibly a new species. When he traveled to see the plant himself, he was certain of its novelty. His confirmation started the process of documenting this new species. The meadows in the vicinity of the first collections were scoured for additional populations and several herbaria were searched to examine other bog-orchid specimens for previous collections. An additional specimen, collected in 1936 by Yosemite ranger naturalist, Enid Michael, was found in the Yosemite Museum herbarium. Once the surveys were completed and the species' presence, or lack thereof, was verified in herbarium collections, *Platanthera yosemitensis* was formally described as a new species in an article published in the journal of the California Botanical Society, *Madroño*. The name was chosen to commemorate the place of its discovery and the location of all known populations at the time—Yosemite National Park.

Features that distinguish the Yosemite bog-orchid from the more common bog-orchid species in Yosemite meadows are its yellow flowers and short sack-shaped nectar spur.

The Yosemite bog-orchid is the only known orchid species endemic to California's Sierra Nevada range. To date, it has been found in only ten wet montane meadows between the main stem and the South Fork of the Merced River and, more recently, in three meadows in the Sierra National Forest south of the park. Additional locations in the region are expected to be found now that it has been described. It is listed by the California Native Plant Society as a rare plant .

We know a moderate amount of information at this point about its biology. Its blooming time is July to August. Its musky smell and short nectar spur suggest pollination by short-tongued insects such as flies or mosquitoes, but none have yet been observed in the act of pollination. Genetic studies to determine its closest relatives are pending. Geologic evidence suggests that the meadows where it grows are ancient environments that escaped the last glacial surge—about 10,000 years ago. The area around these meadows, possibly a result of habitat stability, supports at least seven other species of rare plants known only from the central and southern Sierra Nevada. These include Yosemite onion (*Allium yosemitense*), Yosemite woolly sunflower (*Eriophyllum nubigenum*), short-leaved hulsea (*Hulsea brevifolia*), Yosemite ivesia (*Ivesia unguiculata*), and Bolander's clover.

The saga that led to this new species coming to light highlights the importance of maintaining plant specimen collections. If the Rancho Santa Ana Botanic Garden had not maintained Grinnell's specimen for decades and other contributors had not added new specimens to the botanic garden's collections, the clues necessary for solving the puzzle would not have been available. Contrary to the common impression that new species are found by explorers in remote locations, it is now increasingly common for discoveries to be made upon examination of dried specimens in herbaria. Recently it has been proposed that more than half of the world's

The Yosemite bog-orchid (background) shares wet meadow habitat with the more common white-flowered bog-orchid (foreground).

"undiscovered" flowering plants already exist as specimens in herbaria worldwide. It is often the case that decades elapse between a plant's first collection and an encounter by a plant taxonomist with sufficient expertise to recognize and describe it.

Joseph Whipple Congdon, who was a Mariposa attorney and an avid plant collector, made the earliest collection of Yosemite bog-orchid from

The year after the new bog-orchid species description was published, a new first chapter in this story emerged. George Henry Grinnell followed in the footsteps of an earlier collector in this region whose specimens had not yet come to light at the time of publication. This was Joseph Whipple Congdon, a lawyer who practiced in Mariposa County from 1882-1905. Congdon was respected in his profession, but its how he spent his free time that has since won him immortality in California botany—several species bear his name. He was a dedicated field botanist whose personal collection of some 12,000 plant specimens, primarily from the Sierra Nevada foothills and Yosemite, was purchased by the University of Minnesota upon his death. In 2008, the University of Minnesota herbarium curator sent Congdon's orchid specimens to Sheviak for inspection. It was soon learned that the honor for the first collection of the Yosemite bog-orchid goes to Congdon who brought it back from an expedition to the "Mariposa Big Trees" (now Mariposa Grove of giant sequoias) in 1895. Congdon's specimen bore the name *Habenaria huronensis*, after the species known at the time that Congdon thought it most closely resembled. The specimen at University of Minnesota now bears the correct name. As herbaria put their holdings online in searchable databases, the task of finding such specimens becomes much easier and many more such finds are occurring. (For an example, see the Consortium of California Herbaria searchable database: http://ucjeps.berkeley.edu/consortium/about.html).

If reserve managers are to protect rare species and overall biological diversity, they need the fullest accounting possible of the biological diversity within their jurisdiction and of the potential threats to

Yosemite Museum registrar Miriam Luchans displays a type specimen of the Yosemite bog-orchid in the Yosemite Museum herbarium in Yosemite Valley. Although the Yosemite Museum herbarium is relatively small with just more than 7,000 specimens, it is a significant collection of Yosemite region specimens, both historic and current. Used as a reference by park staff, the Yosemite Museum herbarium will soon join the online searchable database Consortium of California Herbaria, which will make information on its holdings accessible to the world.

populations, species, or overall diversity. New species of plants, animals, fungi and microbes continue to come to light in Yosemite and elsewhere in California. The age of discovery has not vanished from even our most iconic parks and our most well-studied reserves. Since the Yosemite bog-orchid was discovered and its populations mapped, park managers have taken protective measures to ensure it's survival. ▪

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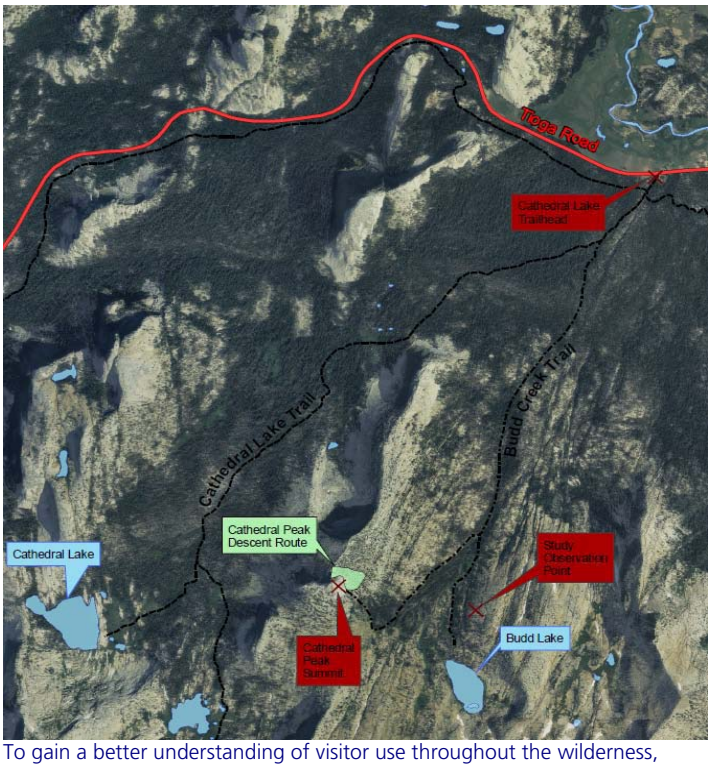
Climbing Cathedral Peak

By David Pettebone, Ph.D.

An important component to developing effective resource protection strategies is understanding visitor use patterns at attraction areas. One of those areas in Yosemite National Park is Cathedral Peak in Tuolumne Meadows, a popular alpine climb for technical rock climbers. John Muir made the first ascent of Cathedral Peak in 1869, which is considered the first successful Class IV ascent in the Sierra Nevada mountain range. Since then, thousands of climbers have ascended this picturesque peak. One contributing factor to Cathedral Peak's popularity is its close proximity to Tioga Road. The approach to Cathedral Peak begins at the Cathedral Lake trailhead and is a relatively easy 3.5-mile hike to the base of the peak.

Cathedral Peak is located in designated Wilderness. Park staff has collected anecdotal evidence to suggest increasing levels of use on Cathedral Peak in recent years. Park managers are particularly interested in gaining a better understanding of visitor use throughout the wilderness, because they are tasked with ensuring resource impacts (for example, vegetation trampling) and social impacts (for example, crowding) are kept in check.



To gain a better understanding of visitor use throughout the wilderness, Yosemite's social scientists defined a Cathedral Peak study area in 2009.

In summer 2009, Yosemite National Park conducted a study of descent routes used by thousands of technical rock climbers after reaching the Cathedral Peak summit.

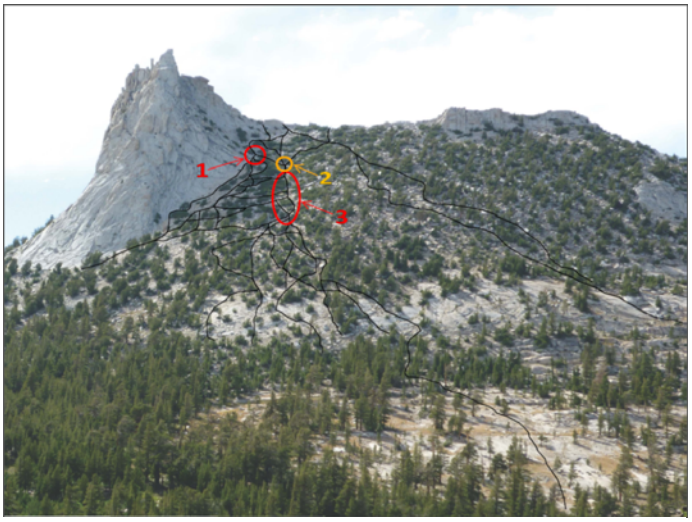
To understand visitor use on Cathedral Peak, a summer 2009 Yosemite National Park study occurred to document the various descent routes used by climbers after reaching the summit. There has been a number of issues associated with the descent routes from Cathedral Peak. The descent routes are dispersed and expansive by nature compared to the cable route used by climbers to ascend and descend the east face of Half Dome. Visitor use was documented by observations from a remote point, using a high powered scope.

Results from the Cathedral Peak study revealed some similarities between weekend and weekday use. Both groups had about two people per party, arrived at the base of the peak about 10:20 a.m., began their technical ascent (on average) before 11:00 a.m., spent about 3.5 hours ascending Cathedral Peak, and descended from the saddle north of Cathedral Peak to the base of the peak in about 15 minutes. The study also revealed some notable differences between weekday and weekend use. Climbing parties were smaller during weekdays—an average of about six climbing parties vs. 14 on weekends. Total numbers of climbing parties was also higher on the weekend. The maximum of 11 climbing parties observed on weekdays increased to 19 on weekends.

Overall, visitor use on Cathedral Peak is low compared to other areas of the park, but the dispersed and unmanaged nature of the use around Cathedral Peak may impact natural resources and potentially affect visitor experiences. By understanding the climbing experience on Cathedral Peak, park managers can develop strategies to minimize impacts.

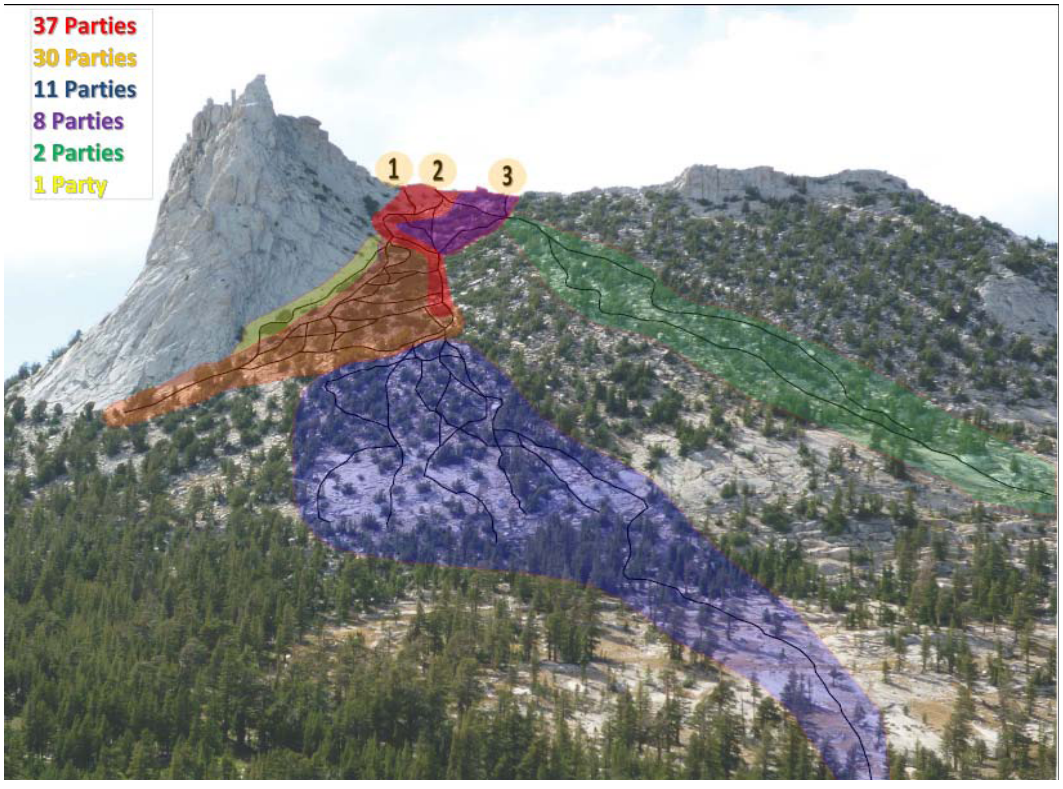
The data show that before starting their ascent, climbers spend about 30 to 40 minutes at the base of Cathedral Peak milling about, organizing gear, going to the bathroom—potentially trampling vegetation and leaving waste behind. In addition, some climbers leave gear at the base (e.g. hiking shoes, jackets, food items, backpacks, etc.) while they climb. This practice may attract wildlife. It is also important to note weekend climbing use is substantially higher than weekdays; therefore, the longer times spent at the base of the peak during weekends may be due in part to crowding as parties wait to begin climbing. Crowding conditions may also have an impact on the climber's experience. Knowing more about use patterns can guide park management strategies to minimize impacts to park resources.

A number of issues associated with the descent route from Cathedral Peak are cause for concern to park managers. The complexity of the informal trail network documented in this study indicates that variation in descent routes from Cathedral Peak. Most climbers (70%) who descend along the north side of Cathedral Peak return to the base. Of these climbers, most of them (60%) traverse across the slope and use a variety of available trails. The large area and unmanaged nature of these trails may lead to slope destabilization through soil erosion and vegetation community fragmentation. In addition, the remaining climbers who did not return to the base of Cathedral Peak descended directly to the Budd Creek trail using the same network of trails, but then continuing down the fall-line of the slope towards Budd Creek. Trail alignments close to the angle of the fall-line are also prone to soil erosion.



This enhanced photograph marks the three entry points where Cathedral Peak climbers entered the descent route in a summer 2009 study.

This social science data along with other data that have been collected throughout the park are being used by park planners and managers. Park planners, for example, use social science data to inform decisions about improvements to facilities other infrastructure improvements. Park managers use this data to monitor safety, manage traffic, and protect resources. The information provided in this report specific to Cathedral Peak informs park managers about potential actions to minimize current as well as future impacts. ▪



A digitized photograph marks the three key junctions where climbers decide their Cathedral Peak descent route.

What Makes a Vista Scenic?

By Kevin McCardle

Many visitors experience Yosemite through scenic drives and taking photographs of the park's iconic images. In visitor surveys, sightseeing and scenic driving are consistently mentioned as the most popular visitor activities. Many of Yosemite's scenic vistas are historic and occur along the major roads of the park. Maintaining these scenic vistas for visitors to enjoy is a perpetual endeavor — requiring a mix of science, art, manual labor, and most of all vigilance. For without continual management, vegetation can grow up and obscure the view as evidenced by the series of photographs below.

When set aside in 1864, Yosemite Valley and Mariposa Grove were the first scenic natural areas in the United States protected for public benefit and appreciation of the scenic landscape. One of the purposes in creating the National Park Service ...*is to conserve the scenery*... Principles and standards for building roads in the National Parks that reveal the dramatic scenery began with an agreement of understanding between the National Park Service and the Bureau of Public Roads in 1925. Tunnel View, at the east end of the Wawona Tunnel, was constructed in 1932 and is one of the most visited examples of these standards. The site was rehabilitated in 2009 to address several issues, including visitor safety, but also reopened the dramatic view originally intended.

The openness of the vegetation found in the park by early visitors and inhabitants created many vistas, particularly in the highly scenic Yosemite Valley. Indian inhabitants and early visitors often described the ability to see the valley floor from one side to the other, an experience not possible today. In the past, the vegetation in the park had been managed by American Indians through many cultural practices that included fire. The suppression of these practices, suppression of lightning-ignited fire, and the alteration of the valley's hydrology are major reasons that many vistas in Yosemite Valley, and the park, are obscured today. In 2009, park staff inventoried 181 scenic vistas in Yosemite and found that encroaching vegetation partially obscured over half the vistas and completely obscured about one-third of the vistas.

Recognizing the importance of preserving these majestic views, the park recently completed a *Scenic Vista Management Plan.* This plan establishes a systematic program to document, protect and re-establish Yosemite's important viewing areas and vistas with actions in concert with the natural processes that created them.

Re-establishing vistas under the *Scenic Vista Management Plan* is a two-step process: the first step is deciding which vistas; the second step is determining what management actions are appropriate. Determining which vistas in a scenic park such as Yosemite is a daunting issue. Hundreds of locations may be considered vista points to a variety of visitors. Identifying which vista points are most important to the park and the visitor's experience is most

View of El Capitan in1868. Selected to represent Yosemite in the postage stamp series.

Postage stamp series view in 1940. Before selective thinning to restore view.

Same view taken in 1940 after selective thinning.

Same View in 1990. Obscured by vegetation

critical. A vista may be important because of its unique beauty, another because of historic events, and still others because of the numbers of likely visitors seeing the park at a given location. These points have widely varying degrees of historic documentation.

A key challenge in developing the *Scenic Vista Management Plan* was striking the right balance between preserving historic views and allowing natural processes to prevail. Re-establishing vistas because of their cultural importance must be balanced with the need to manage natural resources. Objectively assessing the cultural importance can be done in many ways with varying degrees of formality and standardization. To complete this task, a team of park staff developed an approach for comparing various sites. The system developed for Yosemite is an adaptation of the Blue Ridge Parkway system used to rate the cultural importance of vistas to visitors. This tool is referred to as a Visual Resource Assessment (VRA) and provides a structure in determining the value of scenic vistas. The team at Blue Ridge Parkway spent several years developing this program, working with academic researchers, and using public input.

By assigning a numerical value to features of a site that range from the level of infrastructure present to the depth and variety of scenery, vista points can be compared and assigned a band of high, medium, or low cultural value. Different people performing VRA analysis at the same point may obtain different scores, but the structure of the VRA ensures that the scores would at least be close. This provides a mechanism to regulate the process and provide a reasonably predictable program over a wide range of sites.

In addition to the VRA, the *Scenic Vista Management Plan* prescribes the management intensity of vegetation clearing at each vista based upon the vegetation communities present at each vista site. The Yosemite landscape encompasses a remarkable range of vegetation communities, as it rises from 2,000 feet to over 13,000 feet. The diverse vegetation in the park includes foothill chaparral, giant sequoia, California black oak, and lodgepole pine. Some vistas encompass more than one vegetation community. The vegetation types described in the *Yosemite National Park Fire Management Plan* form a basis for specific clearing prescriptions, and supplemented by site-specific ecological information. ▪

Tunnel View in1933, after completion of the Wawona Tunnel.

Tunnel view before restoration, April 2007. Iconic views of Half Dome and Bridalveil Fall are obscured by conifer trees.

Dramatic view of Yosemite Valley is restored in March 2008.

Piecing Together the Past: Chinese Immigrants in Yosemite

by Stephanie Guerra

There's no question that Yosemite's majestic mountain peaks and monumental scenery attract and captivate visitors. But behind each mountain, upon each road, and within each of the vast meadows and forests, are human stories waiting to be told. Finding these stories, though, can sometimes be challenging—that's where ethnohistory comes in. In recent years, National Park Archivist James Snyder and a number of interpretive rangers, such as Shelton Johnson and Yenyen Chan, have explored the cultural history of Yosemite National Park. While their work represents steps toward incorporating the diverse histories in Yosemite's historical and cultural narrative, cultural resource managers have opportunities to contribute additional ethnohistorical insights, enrich our knowledge of the park's cultural history, and reflect the diversity of park patrons, surrounding communities, and the nation.

Ethnohistory research draws on methods and concepts from the fields of history and cultural anthropology to develop a more holistic and inclusive account of the history of human experience and cultural change. A primary goal of ethnohistory is to go beyond the information contained in documents written by and for a single group to understand the cultural and social contexts within which historical events have occurred, popular opinions shaped, and cultural traditions transformed. To accomplish this goal, practitioners compare and integrate information from a variety of sources, including official and unofficial documents, oral tradition, photographs, maps, ethnographic materials and writings, archeological findings, folklore, paintings, ecological data, oral histories, and contemporary traditions and practices.

Miners pose for a photo during the California Gold Rush at Auburn Ravine in 1852. NPS, Photographer unknown.

One area of ethnohistorical interest in Yosemite is the experiences of Chinese immigrants, which was recently explored by the park's interpretive rangers and cultural anthropology staff. Through examining a variety of existing sources and records, the story of their Yosemite experience is emerging.

In 1870, Olive Logan wrote *"Does it Pay to Visit Yo Semite?"* for *Galaxy Magazine*. As she travelled to Yosemite, Olive encountered miners, immigrants, and herders. In her stagecoach, Olive saw "Chinese and Chinese and yet again . . . Chinese gambling, and Chinese mining and irrigating and planting and . . . on horseback." While Logan's story was recorded in *Galaxy Magazine*, the experiences of Chinese immigrants are less apparent. By examining Chinese Camp, California, and the contributions of Chinese immigrants within Yosemite, we are able to recognize the cultural connections that link Chinese immigrants in and around the Yosemite region to Yosemite's diverse past.

Chinese populations were present in California before the creation of Yosemite National Park in 1890. As environmental and social strife catalyzed Chinese immigration, many Chinese found refuge in California. Founded in 1849, Chinese Camp stands as a marker to the contributions made by Chinese populations in the Sierra Nevada region. Located west of what is now Yosemite National Park, Chinese Camp connected San Francisco to mining and grazing communities before the arrival of tourists in 1855 and more than a decade before the arrival of John Muir.

Chinese workers throughout California in and around the Sierra Nevada region of Yosemite faced many challenges. Ostracized for their language and cultural traditions, Chinese miners were also forced to pay a foreign miner's tax. De-

spite overt discrimination they faced on a regular basis, the Chinese community overcame obstacles and remained in the area, worked mines, and established their own communities and businesses.

The 1860 California Census provides a portrait into the past. From merchants, to housekeepers, cooks and doctors, Chinese workers shaped their community and environment. Although preliminary research has not uncovered primary accounts of Chinese workers' experiences from their own perspectives, artifacts and environmental features allow us to piece together pieces of the past. Archeological artifacts such as pottery shards and utensils allow researchers to assess what immigrants did on a daily basis.

By 1880 the population of Chinese immigrants that came to California decreased, perhaps due to hostilities surrounding "coolie labor" which was manifested in the passage of the Chinese Exclusion Act of 1882. Nonetheless, the influence of Chinese workers and communities can be found in traveler's accounts and archeological evidence. . An examination of road construction and labor in Yosemite National Park further illuminates the presence and contributions of Chinese groups.

In 1874 the Coulterville and Yosemite Turnpike Company began construction of the Coulterville and Big Oak Flat Road to Yosemite Valley. Fifty Chinese workers were hired in December of 1874 and their numbers quickly grew to 300. They labored arduously through snow and unforgiving winter cold and completed the bulk of construction by April, when the first wave of tourists began entrance from Wawona. Tourists enjoyed walking over unfinished portions of road as Chinese laborers disassembled, carried, and reassembled their wagons. Chinese immigrants began work on the Great Sierra Wagon Road in 1882. Chinese and Euro Americans worked together as they used blasting powder, graders, and shovels from Tioga Pass to the Sheepherder Mine. Their work extended beyond 56 miles and ended in 1883. In 1919, Charles J. Belden's article "The Tioga Road across the Sierra Nevada" recognized the importance of the road as "a means of establishing a new route across the mountains and opening up the northern part of the Yosemite region." While Chinese immigrants actively reshaped the Yosemite region through arduous labor, they also contributed to Yosemite's growing hospitality industry.

The Wawona Washburn Hartwig Collection, found in Yosemite National Park's archives, provides clues into the role of Chinese workers at the Wawona hotel and within Yosemite National Park. Wawona Hartwig was born into the Washburn family in 1914. Beginning in 1860, her family established roads and a hotel in the Yosemite region. The Wawona Hotel, which she was named after,

Chinese Worker in Yosemite National Park. Circa 1850s.

was managed by her family until 1930 and is frequented by visitors today. Wawona Hartwig's research notes on Yosemite reflect upon her childhood growing up in the Wawona Hotel. Her writings about Chinese employees at the Wawona Hotel reveal that Chinese chefs such as Ah You were much more than culinary talents. Wawona's documents reflect upon the culture and community of Chinese workers who maintained familial and cultural connections beyond Yosemite and beyond the United States.

Ah You's culinary feats are well known in Yosemite's history. His tenure as a chef at the Wawona Hotel lasted forty seven years and, in that time, he cooked for President Harrison and Theodore Roosevelt. While Ah You was known for his delectable dishes, especially his pastries, his personal journey connected with mining and lumber industries and spanned from San Francisco to Yosemite National Park. According to a 1938 *Merced Sun Star* interview, Ah You was born in China in 1848 and arrived in the United States in 1869, where he worked as a cook in San Francisco. Ah You later travelled through the San Joaquin Valley where he also worked as a cook in many hotels and camps. It was his work at Leidig's Hotel in Yosemite Valley that provided an opportunity for the Washburns to convince him to work at their hotel and Ah You began his seasonal work as a chef for the Wawona Hotel in 1879. Wawona Hartwig's writing on her childhood reflected on Chinese workers and praised Ah You for his work and kind

demeanor. Wawona wrote, "Hardly anyone who knew the old Wawone would not have heard of Ah You, the treasure of our Chinese employees. Cooks, laundrymen and gardeners, they were all loyal and efficient, but Ah You was special."

The sale of the Wawona Hotel to the Yosemite Park and Curry Company in 1932 marked the end of employment for Chinese workers. Chinese employees, including Ah You, were replaced by female employees. Six years later, the *Merced Sun Star* interviewed Ah You. At the time of the interview, Ah You, at ninety years old, lived in San Francisco and still had all of the culinary talent he was known for. Yet, there is little documentation of his life after working in Yosemite. While Ah You's experience provides tantalizing clues about the park's history of diversity, locating primary accounts, written by Chinese immigrants would provide valuable insight into this topic. Yet, with continued research and community outreach we can continue to piece together the diverse mosaic of Yosemite National Park.

By exploring ethnohistory, Yosemite will offer additional perspectives on the park experience, acknowledge diverse histories, and connect with communities beyond Yosemite's boundaries. This will engage and develop a new facet of stewardship that not only recognizes the beauty of the park but also acknowledges and values the rich human histories hidden in and on the landscape. ▪

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Keep Up To Date With Yosemite Science

By Elizabeth Munding

Yosemite's science stories have long been accessible to the public through park naturalists but required that you to come to the park and be face-to-face with a ranger to learn about Yosemite's waterfalls, plants, and animals. Today, Yosemite embraces the Internet's online community and social media sites to spread the scientific news, making it easier than ever to keep up to date with what's happening in the park.

Virtual visitors to the park's website (www.nps.gov/yose) get timely news, such as fire updates, flower blooms, fall color, and weather alerts along with "breaking" news, such as the discovery of new species, or the status of current fires. Real-time data is available for a number of monitoring efforts, such as air quality measures and river gaging station information. The public is kept current on fire science, hydro climatology, park planning, and other resource related issues.

In-depth articles and multimedia offerings, such as audio and video podcasts, offer "visitors" the opportunity to connect with the park in new ways. The web-based video series includes *Study the Scientist*, where you can learn about a range of NPS science career options and also the *Yosemite Nature Notes*, a video podcast series, that tells unique stories about the natural and human history of Yosemite National Park. The popular *Yosemite Nature Notes* "Frazil Ice" episode portrays dramatic spring ice flows that occur in streams flowing from the waterfalls of Yosemite Valley. It was watched by more than 1 million people through iTunes, YouTube, and the park website.

The "Study the Scientist: A Hydrologist" video series profiles Jim Roche's work to protect Yosemite's water resources, including two wild and scenic rivers.

Micro-blogging through @YosemiteScience is another powerful science communication strategy. The park's science feed on Twitter currently has more than 1,300 followers. There is some type of science buzz on @YosemiteScience nearly every day. Tweets, like all forms of interpretation, offer "visitors" the opportunity to connect to the park with a daily unique message, such as notification of available reports, datasets, and science-related Yosemite job announcements.

Effective science communication facilitates a deeper understanding of complex science issues across the park service and into educational institutions. Tweets and podcasts are ways to catch the attention of a new type of park visitor and to start a relationship that may inspire our next generation of resource scientists and park advocates. ▪

More than 1 million people have viewed the 2010 Yosemite Nature Notes episode of "Frazil Ice" through iTunes, YouTube, and Yosemite's website.

@YosemiteScience, the park's Twitter feed, informs visitors of park science news on a daily basis.

http://twitter.com/YosemiteScience

Current Park Research

The National Park Service has a research mandate to provide management using the highest quality science and information. Superintendents increasingly recognize that timely and reliable scientific information is essential for sound decisions and interpretive programming. Yosemite National Park welcomes proposals for scientific studies designed to increase understanding of the human and ecological processes and resources in parks and proposals that seek to use the unique values of the park to develop scientific understanding for public benefit. Below is a listing of a small portion of the current research projects underway in the park. More information about these projects and other research can be found on the NPS website. See the Investigators Annual Report database at http://science.nature.nps.gov/research under "Search IARS" and then select Yosemite as the park of interest.

California Acorn Survey

Permit Number: YOSE-2010-SCI-0013 Investigator: Walter Koenig

Climate Impacts on Burn Severity in Three Forest Ecoregions of the U.S.

Permit Number: YOSE-2010-SCI-0010 Investigator: James Lutz

Combining Landsat and LiDAR Remote Sensing to Refine Fire Management Objectives Related to Forest Structural Heterogeneity in Yosemite National Park, CA

Permit Number: YOSE-2010-SCI-0062 Investigator: James Lutz

Data Gathering for Wawona Meadow Restoration and Management Plan

Permit Number: YOSE-2010-SCI-0035 Investigator: Monica Buhler

Determining the Effects of Livestock Grazing on Yosemite Toads (Bufo Canorus) and their Habitat: An Adaptive Management Study

Permit Number: YOSE-2010-SCI-0031 Investigator: Amy Lind

Experimental Ecosystem Restoration of Lakes to Inform Sierra Nevada Yellow-Legged Frog Recovery

Permit Number: YOSE-2010-SCI-0028 Investigator: Heather McKenny

Herpetofauna Diversity in the Lower Tuolumne River in Relation to Dam Release Flow Regimes

Permit Number: YOSE-2010-SCI-0029 Investigator: Heather McKenny

National Register of Historic Places Nomination for the Half Dome Cables

Permit Number: YOSE-2011-SCI-0001 Investigator: Daniel Schaible

Snowpack Monitoring at Crane Flat for Great Gray Owl Foraging Suitability and Meadow Utilization

Permit Number: YOSE-2010-SCI-0008 Investigator: Adam Burns

Upper Tuolumne Riparian Vegetation Study

Permit Number: YOSE-2010-SCI-0094 Investigator: Monica Buhler

Yosemite Forest Dynamics Plot

Permit Number: YOSE-2010-SCI-0003 Investigator: James Lutz

Yosemite Toad (Anaxyrus Canorus) Population Status, Distribution and Trends

Permit Number: YOSE-2010-SCI-0030 Investigator: Heather McKenny

Yosemite Toad (Bufo Canorus) Population Status, Distribution and Trends

Permit Number: YOSE-2009-SCI-0159 Investigator: Heather McKenny

Yosemite Valley Freshwater Macroinvertebrate Biomonitoring Project

Permit Number: YOSE-2009-SCI-0214 Investigator: Adam Burns

Contributors

Alison L.E. Colwell, Ph.D., is a Yosemite National Park biologist focusing on inventory and protection of rare plant species. Alison has a doctorate in population biology and evolution from Washington University in St. Louis, Missouri. Prior to joining the National Park Service in 2008, she worked for the U.S. Geological Survey at the Western Ecological Research Center in Yosemite conducting rare plant surveys for the NPS Inventory and Monitoring program and for the USGS Western Fisheries Research Center in Seattle, Washington, developing genetic markers to track fish parasite epidemics. Her research interests are the central Sierra Nevada flora and the taxonomy of parasitic plants in the family Orobanchaceae.

Stephanie Guerra was Yosemite National Park's 2010 Cultural Resource Diversity Intern. She earned her bachelor of arts in history at the Metropolitan State College of Denver and is currently a master of arts candidate in history at Colorado State University. Guerra's interests include national park history, environmental history, ethnohistory, and cultural resource management.

Kevin McCardle is a historical landscape architect in Yosemite National Park and the project manager for the Scenic Vista Management Plan. McCardle has more than 12 years of professional experience and has worked on a variety of projects in the public and private sectors involving schools, public parks, and stream restoration. He developed an expertise in managing vegetation on historic properties , such as West Point Military Academy, Connanicut Battery in Rhode Island, and others. He holds a Master of Landscape Architecture degree from the University of Minnesota.

Peggy Moore is a plant ecologist with the U.S. Geological Survey stationed at Yosemite National Park. She has a masters degree in range management from the University of California, Berkeley. Moore has 25 years of experience in plant community ecology and has worked on a range of issues in the central and southern Sierra Nevada. These include the distribution of plant life in relation to environment and ecosystem response to management activities. Her studies have included grazing effects on meadows, forest fuel dynamics, exotic plant threat assessment, plant community classification and mapping, and rare plant status and habitat modeling.

Elizabeth Munding is a Yosemite National Park writer-editor who functions as a liaison between the Interpretation & Education and the Resources Management & Science divisions. As a science communicator, she creates a variety of interpretive products, including park Web pages, to share resource information with the public. She has worked as an interpreter at six national parks: Acadia, Sequoia, Kings Canyon, Glacier Bay, Biscayne, and Yosemite. Munding has a master of science in Parks, Recreation and Tourism from the University of Maine-Orono and a bachelor of arts in journalism from the University of Missouri-Columbia.

David Pettebone, Ph.D., is a social scientist for Yosemite National Park Resources Management and Science Division of Yosemite National park. He has conducted visitor use related research in various national parks for six years. His research focuses on understanding visitor travel networks throughout parks and protected areas and the resulting changes to visitor experiences and resource conditions. He previously worked on NPS trail maintenance crews in Kings Canyon, Yosemite, Big Bend, and Rocky Mountain national parks. Pettebone received his doctorate in human dimensions of natural resources from Colorado State University.

Greg Stock, Ph.D., has the distinction of being the first park geologist for Yosemite National Park. He has a bachelor of science in geology from Humboldt State University and a doctorate in earth science from the University of California at Santa Cruz. After completing postdoctoral research at the University of Michigan, Stock began work at Yosemite in 2006. He is a licensed professional geologist in the State of California. His research expertise is in geomorphology, including hill-slope processes such as rock falls and debris flows.

Sarah Stock is a wildlife biologist at Yosemite National Park where she studies wildlife ranging from songbird population dynamics to great gray owl ecology. Prior to joining the National Park Service, Stock directed bird monitoring programs at Idaho Bird Observatory for six seasons and Ventana Wildlife Society's Big Sur Ornithology Lab for four years. She earned her masters degree at the University of Idaho in 2001where she focused on the migration ecology of flammulated and Northern sawwhet owls.

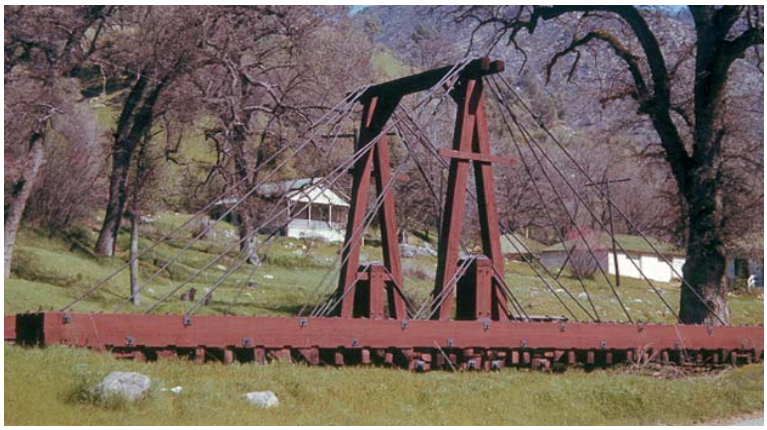
Then...

In 1902, the **Yosemite Valley Railroad Company** was established to provide transportation to the timber and mineral resources of the Sierra Nevada. Additionally, the founders saw the beauty of Yosemite Valley as a natural tourist attraction. In May of 1907, the railroad company opened its initial 79-mile line from Merced to El Portal, Calif., along the Merced River. The original plan included the line's extension from El Portal into Yosemite Valley, but the narrow canyon between the two points precluded that from happening. There would be several bright years in the Yosemite Valley's freight and passenger operations from 1907 to 1928. Unfortunately, it would also see a few deficit years due to a extreme weather-related costs and a floundering U.S. economy. The Depression years spelled financial disaster. In 1937, the railroad went into foreclosure. After reorganization, a new company emerged called the Yosemite Valley Railway, which provided financing to carry on. On April 24, 1945, the company's last train ran only as far as Merced Falls, which was located well before Yosemite's park boundary. Although there were several final attempts to save the railroad, no one could come up with the needed capital, and the Yosemite Valley Railway Company abandoned the line in September 1945.

Yosemite Valley Railroad Turntable in the early1900s.

...and Now

In 2009, a piece of the Yosemite Valley Railroad Company's history was fully rebuilt to spotlight the historic era of the Central Valley railroad. A gallows turntable, left in the historic mining and milling town of Bagby upon the railroad's demise, was transferred to El Portal in the early 1960s. Yosemite's park management, even decades ago, had the foresight to preserve cultural resources any way they could. Although the aim has been to preserve these cultural resources in place, the park occasionally has moved important resources to another location in order to best care for them. (The historic properties located at the Pioneer Yosemite History Center in Wawona are another example of this.) Bagby, a unincorporated community located northwest of Mariposa on Highway 49, had been deserted in 1945 when the railroad was abandoned. Cultural resources, like the turntable, can carry on important Yosemite stories. For this reason, the Yosemite Fund (now called the Yosemite Conservancy) provided funding for the park's preservation crews to rebuild this piece of transportation history. In addition to the turntable, there are three Yosemite Valley Railroad Company houses in El Portal—extensively remodeled—located east of the El Portal Post Office. The other railroad structures in El Portal—the water tanks and the railroad station—also were relocated from Bagby to El Portal prior to the inundation of the town of Bagby in the early 1960s when a new dam was built there. If visiting El Portal, look for other hidden evidence of the railroad's presence: Behind the El Portal gas station is a concrete slab, where stage and motor coaches once lined up to take visitors arriving by railroad into the park. ▪



Yosemite Valley Railroad Turntable, 2009.

Meetings of Interest

Jan. 6-7	California & Nevada Amphibian Population Task Force Annual Meeting **Status of Resources and Conservation Measures** Yosemite National Park
Feb. 8	Yosemite Forum* **Snow, Climate Change, and the Mountain River Cycle** Roger Bales
March 9	Yosemite Forum* **The Application of Geographic Information System to Search and Rescue** Paul Doherty
March 21-22	National Park Service and US Forest Service **Sierra Operations Manager Network Meeting** Yosemite Valley
April 12	Yosemite Forum* **Macro-Fungi** Tom Bruns
May 10	Yosemite Forum* **A Historic and Photographic Overview of Yosemite's Signature Lodges** Leroy Radonovich
June 14	Yosemite Forum* **Seismic and Acoustic Monitoring of Rock Falls in Yosemite Valley** Valerie Zimmer
July 12	Yosemite Forum* **Understanding Climatic Tolerances of Rare Plant Species** Iara Lacher
Oct. 1	Society of California Archaeology Meeting in Yosemite Valley **Sierra Nevada Archeological Resources** Includes walking tour of the Wahhoga Project

*The **Yosemite Forum** is a free interactive lecture series designed to bring evolving knowledge of the Sierra Nevada to the public and the park. Lectures are noon–1 p.m. on the second Tuesday of the month in the Yosemite Valley Auditorium. Yosemite Forum is sponsored by the Resources Management and Science Division in partnership with The Yosemite Fund, the USGS Western Ecological Research Center Yosemite Field Station , the University of California Sierra Nevada Research Institute, and the USFS Pacific Southwest Research Station, Sierra Nevada Research Center.

Note: Schedule is subject to change. For an up-to-date list of Yosemite Forum schedules, go to www.nps.gov/yose/naturescience/yose-forum.htm or follow @YosemiteScience on Twitter at http://twitter.com/yosemitescience.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