Stanton Repeat Photography

A Compilation by:

Yuma County Water Users' Association

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In May 1889, railroad engineer Robert Brewster Stanton, in collaboration with real estate investor Frank M. Brown, began a survey of the Green and Colorado River corridors. Their goal was to construct a railroad line from Grand Junction, Colorado to San Diego, California, one that would wind at river-level through several of the Colorado River’s canyons. While that expedition ended in disaster in July after three men—one of them Brown—drowned in Grand Canyon, Stanton successfully completed the survey that winter (1889-1890).

The expedition quickly discovered that conducting the survey by instrument was far too time-consuming for their allotted time, so the men turned to line-of-site photographs taken on newfangled flexible roll film (rather than the cumbersome glass plates used by their predecessors). Although the railroad project never got past the planning stages, the photographs would prove to be invaluable as the basis for repeat photography a century later.

From 1989 to 1995, we re-photographed nearly all of the images that the expedition’s photographers—Franklin A. Nims and, after Nims was injured and left the expedition, Stanton himself—took in both Grand and Cataract Canyons. The photographs reveal changes in desert and riparian vegetation, rapids, and beaches, as a result of both natural and human-caused processes.

Many of the Grand Canyon images were published in Grand Canyon, A Century of Change, and a selection of the Cataract Canyon images appeared in Cataract Canyon: A Human and Environmental History of the Rivers in Canyonlands. In 2010, we began re-matching many of these images, both in Grand Canyon and Cataract Canyon.
31 May 1889
The Confluence of the Green (left) and the Colorado (center, exiting right) Rivers is the site of many colorful episodes in western history. Denis Julien was the first known explorer of European origin to pass here in the 1830s. The Powell Expedition paused here in 1869 and 1871, and in 1889, the Brown-Stanton Expedition found two plates left by one of the Powell expeditions. The rivers are at flood stage, and the riparian species appear to be mostly native willows with scattered cottonwood trees and possibly a few boxelder trees. Saltbushes occur on the bottomlands in the midground, and a number of desert shrubs, notably Mormon tea, are scattered within the hillslope boulders. The rivers are in low flood stage, and no sandbars are exposed.
Franklin A. Nims, 57-RS-35, courtesy of The National Archives

24 March 1997
The riparian vegetation has greatly increased on both sides of the river, and although most are non-native tamarisk trees, several small groves of boxelders appear across the river on the left, and desert olive with scattered Goodding willows and cottonwood trees are also present. Native riparian species also have increased. Desert vegetation in the foreground is a saltbush community, and a number of four-wing saltbush persist. Biological soil crusts are obvious in this view in contrast with conditions in 1889, when the bottomland had more shrubs and less exposed substrate.
Robert H. Webb

29 July 2010
The foreground saltbush community has changed little in the intervening 13 years, and many of the persistent individuals have grown. Several new peachleaf willows are visible behind the tamarisk along the river, which are dying because of introduction of the tamarisk beetle. The prominent sandbar in the midground is a seasonal feature at this site and heavily used by river runners for campsite, but its size fluctuates annually and seasonally. Biological soil crusts remain prominent, although trails through the bottomlands appear to have widened at the expense of the crusts.
Helen A. Raichle
Mile 216.3, The Confluence, Across Canyon View from River Left (Stake 2706)

30 May 1889
This view across the Colorado River shows the cliffs and hillslopes that tower over the Confluence. The combined rivers are in flood, but a line of native riparian vegetation is apparent in the foreground and across the river. The species that are present are a mixture of netleaf hackberry, desert olive, coyote willow, and a few peachleaf willow, including one that is small but directly across the river. A few Mormon tea and four-wing saltbush are visible in the boulder pile that is just visible at the bottom of the view.
Franklin A. Nims, 57-RS-27, courtesy of The National Archives

21 July 1992
Most of the riparian vegetation visible on both sides of the river are tamarisk, although native species – notably the peachleaf willow that towers above its neighbors across the river – are also present within the sea of non-natives. Several of the desert shrubs in the foreground have persisted since 1889, although what likely was a Mormon tea has died back, exposing more rocks in the foreground on the right. A large sandbar extends from the near shoreline; this sandbar is seasonal but can cover a large area after some spring floods.
Robert H. Webb

29 July 2010
The peachleaf willow towers over dead or dying tamarisk trees across the river, and coyote willow appears to be thriving at the expense of the decimated tamarisk in the foreground. Desert shrubs continue to persist within the pile of boulders in the immediate foreground, and the few perennial grasses present in 1992 appear to be either dead or subdued in this view. The sandbar at center is of more typical size for what generally is present at this site at this time of year, and the sandbar across the river is typical for what generally is present at that site.
Helen A. Raichle
30 May 1889
This upstream view, from the same camera station as Stake 3063a, represents the first swing view taken by Franklin Nims to accomplish his task of documenting the route of the Colorado Canon and Pacific Railroad. The Confluence is left of this view, which mostly shows a bottomland on the Colorado River. Riparian vegetation lining the river includes desert olive, coyote willow, and scattered netleaf hackberry; the bottomland in the midground contains mostly saltbushes; and Mormon tea and shadscale mantle the boulder pile in the foreground. Biological soil crusts are present but are sparse owing to the coarse surficial deposit.
Franklin A. Nims, 57-RS-38, courtesy of The National Archives

2 June 1993
A small debris flow has added sediment to the foreground, including the prominent rock in the right foreground. The additional fine-grained sediment has promoted establishment of biological soil crusts, which quickly establish on dolomite-rich substrates such as this. The Mormon tea in the center of the view persists despite the deposition, although one to its right has died; many four-wing saltbush and shadscale persist in the view. Tamarisk towers over what was a native stand of riparian vegetation, although one clump of desert olive is apparent at left center. Rubber rabbitbrush has established on the bottomland behind the tamarisk and is taller than the saltbushes on this surface.
Robert H. Webb

29 July 2010
The mosaic of brown tamarisk and green coyote willow and desert olive shows the change spurred by tamarisk leaf beetles, which are highly effective in killing tamarisk in Cataract Canyon. Both the rubber rabbitbrush and four-wing saltbushes on the floodplain have persisted and have grown, and non-native Russian thistle growing among the taller shrubs generally obscures the previously barren intershrub area, which was mantled with biological soil crusts. Those crusts are more apparent in the foreground, probably because of recent rainfall but also possibly increasing in density as establishment continues on the historic debris-flow deposit. Several Mormon tea and shadscale individuals at center and in the right foreground persist, and some of these clearly are more than 121 years old.
Steve Young

Mile 215.8 Just Downstream from the Confluence, Upstream View from River Left (Stake 3063b)
Mile 215.8, Just Downstream from the Confluence, Downstream View from River Left (Stake 3063a)

30 May 1889
This downstream view shows the bottomland on the left side of the Colorado River and the riparian vegetation that mantles both banks. On the near (left) bank, the species present are the usual ones, including desert olive, Goodding willow, netleaf hackberry, and coyote willow. The desert vegetation includes Mormon tea and other species on the rocky slopes to the left and saltbushes on the finer-grained bottomlands to the right. The finer-grained soils sustain biological soil crusts, which are apparent at right center. The front barrel of the transit that Stanton used to survey this part of his railroad route is visible on the left side, and one of the surveyor helpers is seated in the center of the view but is hard to discern in the grainy image. Franklin A. Nims, 57-RS-65, courtesy of The National Archives

2 June 1993
A small debris-flow deposit now mantles the cone of soil extending from the left side of the view, likely originating from the local cliffs of Honaker Trail Formation. The extent of deposition is apparent from the exposure on rocks to the left and the residual extent of biological soil crusts on the right. Rockfall have added new boulders to the view, notably in the midground. These changes, while affecting the immediate foreground and the camera station, did not cause significant changes to most of the view, where persistent rocks are surrounded with several persistent shrubs, including Mormon tea to the left and four-wing saltbush to the right. Robert H. Webb

29 July 2010
Yet another rockfall has occurred in the midground to the left, and the new rocks appear fresh and white compared with those that have been laying on the surface of the bottomland since at least 1889. Many shrubs have died, probably during the severe drought that prevailed over most of the intervening 17 years, but many individuals in the midground persist, including four-wing saltbush, Mormon tea, and shadscale. Biological soil crusts are prominent, in part because fewer shrubs are in the foreground and recent rainfall.
Steve Young
Mile 215.3, Downstream from the Confluence, Upstream View from River Left (Stake 2621)

31 May 1889
This upstream view documents the potential route of the Colorado Canon and Pacific Railroad and clearly shows details on the bottomland on the left side of the Colorado River. Thick biological soil crusts are prominent in the intershrub areas of the foreground and midground, and these crusts surround various shrubs, including saltbushes and seepweed. The riparian zone includes a mixture of Goodding willow, coyote willow, desert olive, and netleaf hackberry. Several individuals of what appears to be plains pricklypear are visible in the foreground.
Franklin A. Nims, 57-RS-30, courtesy of The National Archives

21 July 1992
The plains pricklypear have died, and shadscale has increased in the view. The biological soil crusts remain but are subdued in this view, at least in part because of non-native cheatgrass, which is locally dense on these bottomlands. Although some native riparian species persist, they are partially hidden in the sea of non-native tamarisk, which obscures the view of the river. Native trees appear in a line at the center; from left to right, these are a boxelder tree, a Goodding willow, another boxelder tree, and a netleaf hackberry; the plants at this location in 1889 appear to be desert olive and hackberry. A number of shrubs persist on the bottomland, including four-wing saltbush, seepweed, and shadscale.
Steve Tharnstrom

29 July 2010
Most of the shadscale in the foreground have died, likely the result of the protracted drought over the intervening 18 years. Biological soil crusts are again prominent despite some new seepweed, globemallow, and non-native Russian thistle. Unlike other sites nearby, pricklypear has not reestablished. Water in the Colorado River is again visible through a gap caused by the death of a boxelder tree, but the Goodding willow, the second boxelder, and the netleaf hackberry persist.
Steve Young
Mile 215.3, Above Spanish Bottom, Downstream View from River Left (Stake 3064)

31 May 1889
This view shows the proposed route of the Denver, Colorado Canon and Pacific Railroad on the left side of the Colorado River at the head of Cataract Canyon. Between the Confluence and Lower Red Lake Canyon in 1947, Harry Aleson, a well-known river runner in the mid-20th century, looked in vain among boulders such as these for a Denis Julien inscription, carved in the early 19th century and mentioned by Frederick Dellenbaugh in his book A Canyon Voyage. Aleson finally found the inscription in 1951 near Lower Red Lake Canyon. The bottomland sustains saltbushes and seepweed, and many of the plants along the river are desert olive and netleaf hackberry. The identity of other foreground plants in this grainy view cannot be discerned.

Franklin A. Nims, 57-RS-67, courtesy of The National Archives

3 June 1993
Rockfalls dominate the river terraces in much of Cataract Canyon, but nowhere is this as dramatic as just above Spanish Bottom. Nims appeared enamored with the large boulder in the foreground, and thus captured one of the few places that has remained relatively rock-fall free in the last century. However, notice the house-size rock in the mid-ground center that has rolled down since the original photo. Seven persistent shadscale individuals can be seen on the left side of the photograph, and a newly-established hackberry bush appears in the right foreground. The register box for Cataract Canyon river trips is across the river from this camera station.

Robert H. Webb

3 June 1993
Rockfalls dominate the river terraces in much of Cataract Canyon, but nowhere is this as dramatic as just above Spanish Bottom. Nims appeared enamored with the large boulder in the foreground, and thus captured one of the few places that has remained relatively rock-fall free in the last century. However, notice the house-size rock in the mid-ground center that has rolled down since the original photo. Seven persistent shadscale individuals can be seen on the left side of the photograph, and a newly-established hackberry bush appears in the right foreground. The register box for Cataract Canyon river trips is across the river from this camera station.

Robert H. Webb
Mile 215.0, Downstream from the Confluence, Downstream View from River Left (Stake 2430)

31 May 1889
This downstream view from the top of a large boulder shows surveyors at work on a bottomland on the left side of Cataract Canyon. This bottomland mostly has saltbushes and seepweed, and biological soil crusts are prominent throughout the foreground. The riparian vegetation, which appears dark in this grainy image, is mostly desert olive with some netleaf hackberry.
Franklin A. Nims, 57-RS-33, courtesy of The National Archives

15 October 1999
Rockfalls have strewn new boulders throughout the view, most notably in the immediate foreground. Considerable turnover has occurred in the desert vegetation, notably in the saltbushes and seepweed, and the biological soil crusts are not prominent but are clearly present. The desert olives have persisted as a stand, although individuals are difficult to discern with species such as this that sprout from below ground. A new boxelder appears on the right side of the view. John Weisheit occupies the approximate position as one of the Brown-Stanton surveyors.
Dominic Oldershaw

29 July 2010
The turnover in desert vegetation has continued, particularly in the saltbushes and seepweed. The desert olive stand and scattered netleaf hackberry continue to persist, and the boxelder has survived the intervening 13 years. The biological soil crusts are more prominent in this match, in part because rainfall has recently occurred. Robert Webb occupies the same position as Weisheit did 11 years before.
Helen A. Raichle
Mile 215,0, Just Downstream from the Confluence, Downstream view from River Left (Stake 2431)

31 May 1889
This view is one of Nims’ first in Cataract Canyon, which occurs downstream of the Confluence of the Green and Colorado River and extends to the end of Mille Crag Bend upstream from Narrow Canyon and the mouth of the Dirty Devil River. A dense stand of saltbushes and seepweed is present throughout the foreground and midground, and riparian vegetation along the right side of the view is a combination of mostly netleaf hackberry and a few desert olive.
Franklin A. Nims, 57-RS-31, courtesy of The National Archives

15 October 1999
A debris flow has crosses the view from a high-angle chute out of the view to the left, but the boulders deposited by this flood are apparent in the midground. This change exemplifies the foreground and midground of this view, where few desert shrubs have persisted the last 110 years. In contrast, most of the netleaf hackberry and at least one desert olive have persisted, showing that unlike other reaches of the Colorado River, the riparian zone is more stable than the desert vegetation.
Dominic Oldershaw

30 July 2010
Although one seepweed individual in the foreground clearly persists over the last 11 years, more turnover has occurred here, probably because of the severe drought that marked the first decade of the 21st century. Grizzlybear pricklypear cactus is now prominent, but this partially could be because shrubs that blocked the view of some patches in the 1999 view have died. Mormon tea individuals that have grown up in the debris-flow deposit look strikingly similar compared with the 1999 view. Biological soil crusts are prominent in the foreground and midground, in part because rainfall occurred shortly before this photograph was taken and the fact that the density of shrubs has decreased.
Steve Young
31 May 1889
This downstream view on river left shows the short, right bend upstream from Spanish Bottom and the anhydrite dome at the mouth of Lower Red Lake Canyon (center). Missing emulsion on the paper-stripping negative mars the hillslope and cliffs on river right. The riparian trees along the river include netleaf hackberry (higher stature), desert olive (lower stature), and one boxelder tree in the distance. The desert vegetation includes Mormon tea among the rocks in the foreground and on the left, and saltbushes on the flatter and finer-grained sediments behind the riparian vegetation on the right. A patch of biological soil crust appears around and to the right of boulders in the center of the view.
Franklin A. Nims, 57-RS-34, courtesy of The National Archives

22 July 1992
Numerous shrubs persist in the desert vegetation, including Mormon tea in the foreground and on the left side among the rocks, and four-wing saltbushes on the finer-grained soils. Tamarisk has joined the line of riparian vegetation, but netleaf hackberry and desert olive have persisted and are joined by a new boxelder in the distance. Along the far right bank, coyote willow has colonized the once barren banks, joined by tamarisk.
Steve Tharnstrom

30 July 2010
Tamarisk is dead or dying from tamarisk leaf beetles, and the mosaic of brown and green trees shows the non-native and native species here. Desert olive and netleaf hackberry, while sparse, continue to persist, and coyote willow on the far right bank has increased. Many of the foreground shrubs, including four-wing saltbush, Mormon tea, and shadscale, persist, but non-native annuals, including Russian thistle and brome grasses, are very common here. The patch of biological soil crust in the midground is more prominent, possibly because of recent rains.
Robert H. Webb
31 May 1889
In this view, from a camera station upstream from Rapid 1 and just downstream from Lower Red Lake Canyon, a crew member of the Brown-Stanton Expedition holds a survey rod marked in one-foot increments. He is sitting on a flank of the evaporite diapir covered with gypsic soils. Biological crusts thrive on gypsic soils, and the flats in the foreground and midground are black with dense crusts. The extensive bottomland has a vegetation assemblage dominated by Mormon tea but also including many other shrubs, notably saltbushes, and perennial grasses. The slope at lower left has a stand of shadscale.
Franklin A. Nims, 57-RS-39, courtesy of The National Archives

s2790-1889
Many trails have been created through the soil crusts on this flat. No trails are visible in 1889, indicating that the modern trails are a result of people, not animals. Destruction of ancient soil crusts is harmful to the ecosystem in Cataract Canyon; to protect this resource, the National Park Service requests that hikers stay on trails. Much of the native riparian vegetation has been replaced by tamarisk along the river corridor. The tamarisk trees are taller than native willow, and the tamarisk now blocks the view of most of the river. In the foreground are seepweed plants that appear to be persistent. The midground is dominated by a number of persistent individuals, including shadscale, greasewood, and Mormon tea, and two new pricklypear are present. The hillslope at left is unstable, and no shadscale appears to persist on it.
Steve Tharnstrom

30 July 2010
The trails through the soil crusts are still well defined and heavily used, although there are no new trails visible. Shadscale dominates the foreground, and a new pricklypear is visible in the right foreground. As in 1994, many individuals of Mormon tea, shadscale, and greasewood persist on the bottomland. The tamarisk in the midground have largely died off due to damage by the tamarisk leaf beetle, revealing more of the coyote willow along the river banks.
Robert H. Webb
Mile 214.1, Across from Spanish Bottom, Downstream View from River Left (Stake 2339)

31 May 1889
This downstream view shows a surveyor with the Brown-Stanton Expedition of 1889. Water in the Colorado River is close to the annual peak for this year. Spanish Bottom appears across the river and is marked by a line of riparian vegetation, including prominent cottonwood. Although it is difficult to determine the species from this distance, the large clumps (extreme right) appear to be desert olive, and the shoreline plants appear to be coyote willow. The dense shrubs just to the right of the surveyor are desert olive, a native riparian shrub. The plants around the surveyor are slightly out-of-focus and are impossible to definitively identify, although some have the same branch and leaf characteristics as longleaf brickellbush.

Franklin A. Nims, 57-RS-37, courtesy of The National Archives

22 July 1991
Considerable change has occurred at this site owing to the combination of tamarisk and fire. Tamarisk forms a nearly impenetrable barrier on river right above the waterline. In the 1980s, a fire that was accidentally started on channel left (downstream from this camera station) swept upstream beyond this point; then embers blew across the river and started another fire in Spanish Bottom. A dead cottonwood, established after 1889, appears on channel left, and a combination of snags and trees that survived the fire are on river right. Cottonwood increased on Spanish Bottom before the fire and remains more numerous here than in 1889. Desert olive may not have been as fortunate; stumps are common along the top of the terrace at Spanish Bottom. Jack Schmidt is in the foreground, and a persistent individual of desert olive appears just to his right.

Robert H. Webb

30 July 2010
Considerable turnover has occurred in the vegetation throughout the view owing to human-caused wildfire on both sides of the river at Spanish Bottom. This fire may have promoted non-native species, including Russian thistle and Russian knapweed, both of which occur in this area. Bob Webb occupies the position of the Brown-Stanton surveyor in the foreground, and that same desert olive, now joined with a dense stand of healthy coyote willow and dying tamarisk, is just beyond him to the right.

Steve Young
31 May 1889
This view shows the flanks of the anhydrite diapir at Lower Red Lake Canyon on the right. This diapir is called the Prommel Dome, named after a petroleum geologist who visited the area in the 1920s. River crossings have also occurred nearby as the drainage provides a route out of this Colorado River gorge. One such river crossing occurred in the 1890s to ford cattle stolen by Butch Cassidy and the Robber’s Roost gang. The dense riparian vegetation along the left side of the view (river left) appears to be desert olive, a native species, and a few cottonwood trees are apparent on river right at the left edge of the view. The clearly identifiable shrubs on the slopes of the diapir are saltbushes, both four-wing saltbush and shadscale.

Franklin A. Nims, 57-RS-32, courtesy of The National Archives

22 July 1992
The camera station is an unstable slope just below the major river-left hiking trail. In July 1989, hikers from Lower Red Lake Canyon accidentally set fire to a tamarisk thicket. The fire spread upstream on the left bank of the Colorado River, shown here in the foreground, before jumping across the river and then burning downstream through the dense riparian vegetation of Spanish Bottom. Fires due to human negligence along the Green and Colorado Rivers have decimated cottonwood stands, but they also appear to have killed the saltbushes on the slope of the diapir. Seepweed appears in the center foreground with non-native cheatgrass, Russian thistle, and tamarisk.

Steve Tharnstrom

30 July 2010
The instability in the slope hinders an accurate match and removed the camera-station marker. The large, dead cottonwood has fallen over, and its stump is still visible. Seepweed is the dominant plant in the foreground, along with the annual and non-native Russian thistle; the slopes of the diapir once again have both species of saltbush. The coyote willows at left have grown considerably, the burned desert olive have regrown, and many of the tamarisks behind these native species have been killed by tamarisk leaf beetles.

Robert H. Webb
31 May 1889
This downstream view shows Rapid 1, also known as Brown Betty Rapid because of a boating accident that the Brown-Stanton expedition had with their cook boat above this rapid. A grove of Utah juniper dominates the left midground, and netleaf hackberry are readily apparent on the right side of the river. A solitary desert barberry appears on the right side, and numerous Mormon tea and other desert shrubs appear throughout the foreground and midground.

Franklin A. Nims, 57-RS-40, courtesy of The National Archives

28 March 1994
The juniper grove has died back, although some trees persist and a new Utah juniper is prominent to the right of the former stand. Numerous Mormon tea individuals persist in this view, as well as winterfat, several perennial grasses, netleaf hackberry, and desert barberry. Tamarisk has invaded the left side of Rapid 1, although the rapid remains visible. In the left foreground, a patch of biological soil crust appears to be much better developed than it was in 1889.

Steve Tharnstrom

30 July 2010
As in 1994, large numbers of desert shrubs are persistent in this view, and the juniper stand has died back more but individuals are still alive. Few perennial grasses persist from 1889 but several, including needle-and-thread, persist since 1994. The tamarisk have grown, obscuring the center of Rapid 1, but trees are dead or dying because of the tamarisk leaf beetles that are now ubiquitous in Cataract Canyon. Patches of biological soil crusts, particularly in the left foreground, persist here despite considerable foot traffic associated with river runners and backpackers.

Steve Young
31 May 1889
This photograph is unusual because Nims mostly use a landscape format instead of this portrait format for his images. Flow in the river is approximately 40,000 ft³/s, and the right bank, across the river, is mostly barren in the view. On the upstream edge (right side), a stand of low netleaf hackberry is apparent with desert vegetation upslope, including Mormon tea and desert barberry. The steep channel on the left leading down from the vertical cliffs at the top creates the river right debris fan at the head of Rapid 1. This view is also of historical interest because it shows the Brown-Stanton expedition campsite, which was reached after the accident with the cook’s boat, the Brown Betty, that led to name of Brown Betty Rapid and the loss of much of the expedition’s provisions on a makeshift raft.
Franklin A. Nims, 57-RS-22, courtesy of The National Archives

3 June 1993
The discharge in the Colorado River is 70,000 ft³/s, much larger than the water level experienced by the Brown-Stanton expedition 104 years before. The riparian stand of non-native tamarisk and native coyote willow obscures the netleaf hackberry trees, most of which have persisted the intervening 104 years. Numerous Mormon tea and desert barberry individuals persist. A debris flow from the high-angle chute has caused deposition at the head of Rapid 1, causing a slight change in the upper right side of the rapid.
Robert H. Webb

30 July 2010
The river is flowing at about 6,000 ft³/s, or low enough to expose the rocky bank downslope from the stand of coyote willow and non-native tamarisk. The brown color of the dead or dying tamarisk distinguishes that species from the native coyote willow, which now forms a dense, extensive stand downslope from the still-persistent netleaf hackberry trees. Most of the Mormon tea and desert barberry still persist 121 years after Nims’ photograph.
Steve Young
June 1889
Nims took this view on the left side of the river at the head of Rapid 2, looking upstream toward Lower Red Lake Canyon and Brown Betty Rapid (Rapid 1). The camera station is on an early Holocene debris fan that has been truncated by the Colorado River, leaving the ragged, boulder-strewn slopes on the right side. A large number of Mormon tea are visible on the uneroded tops of this old debris fan, and shorter-lived species occupy the steeper slopes down to the riparian zone. The dark-looking trees in the center distance are netleaf hackberry trees closer to the shoreline and Utah juniper upslope and behind. Discharge is about 40,000 ft³/s, and Rapid 1 is mostly washed out at that level.
Franklin A. Nims, 57-RS-48, courtesy of The National Archives

17 September 1921
In 1921, the USGS surveyed the river corridor with the aim of locating potential dam sites. Geologist Sidney Paige coincidentally captured this photograph taken from a position remarkably close to Nims’, albeit at a much lower discharge in the river (less than 10,000 ft³/s) and downslope from the top of the debris fan. The steep slopes have scattered individuals of longleaf brickelbush, a short-lived riparian species. The juniper grove and netleaf hackberry trees appear to be approximately the same, but what appears to be an isolated cottonwood tree appears directly behind two rocks exposed in the river. Tamarisk is not present.
Sidney Paige, 1392, courtesy of the USGS Photographic Library

22 July 1991
At this time, flow in the river is about 7,000 ft³/s, or approximately the same level as in 1921 on the basis of the exposure of the rocks in the channel below Rapid 1. A large number of Mormon tea have persisted the intervening 102 years between this and Nims’ view. Perennial grasses, particularly Indian ricegrass and needle-and-thread, have greatly increased. Persistent netleaf hackberry trees are hidden in a sea of non-native tamarisk, and longleaf brickellbush and coyote willow have increased along the shoreline. What is known as Brown Betty Beach appears on the left side (river right), with a number of persistent netleaf hackberry trees upslope.
Ted Melis
10 June 2002
Although the perennial grasses have mostly died back, some individuals persist along with the Mormon tea in the right foreground. Similarly, most of the netleaf hackberry have persisted and have grown larger, particularly behind the Brown Betty Beach. Stands of coyote willow have expanded on both channel banks, and the number of longleaf brickellbush has greatly increased in the midground along with small tamarisk.
Dominic Oldershaw

31 July 2010
Perennial grasses have again increased, this time including galleta grass in the foreground. Mormon tea shrubs and a number of longleaf brickellbush persist, while tamarisk throughout the view are dead or dying as a result of the tamarisk leaf beetle, which was released upstream in about 2007. The largest change in the netleaf hackberry trees is the noticeable increase in size of individuals, and seedlings are apparent near the long-lived trees. Many of the Utah juniper in the distance are alive although dead snags are also present.
Steve Young
3 June 1889
This view is taken from river left on the edge of an extremely large eddy between Rapids 3 and 4. The channel bank is mostly barren downslope of scattered individuals of netleaf hackberry with desert barberry and singleleaf ash that are slightly upslope. Driftwood collects at this part of the eddy, and one of the Brown-Stanton crew is kneeling on a boulder in the center of the view.
Franklin A. Nims, 57-RS-84, courtesy of The National Archives

23 July 1992
This view was taken at a much lower discharge in the Colorado River, and the river bank is densely vegetated with a number of riparian species, including non-native tamarisk, coyote willow, and longleaf brickellbush. A debris flow from the unnamed canyon to the left deposited a coarse cobble-boulder surface that is just visible in the left midground. Several individuals of netleaf hackberry, desert barberry, and singleleaf ash persist in the view, but the desert barberry individual on the left side of the view is new. Robert Webb is kneeling on the same boulder as the crewman in 1889.
Steve Tharnstrom

31 July 2010
This view is from a slightly different position but shows the same plants and rocks as the original two matches. Netleaf hackberry, singleleaf ash, and desert barberry continue to persist, and the new plant on the left side has grown. The riparian vegetation continues to thrive, most notably the coyote willow at right center, and the tamarisk that is prominent at left center is probably dead, another victim of the tamarisk leaf beetle. Webb stands downslope from the rock he knelt upon in 1992.
Steve Young
4 June 1889
A couple days of progress were lost for the Brown-Stanton Expedition due to camera repairs and difficulties incurred while lining and portaging the boats. Surveying for the railroad bed continued on the left side of the Colorado River through Cataract Canyon. The black triangular area in the upper right corner is the result of Nims’s shading the lens from the sun. Some distinctive pieces of driftwood are lying parallel with the river in the foreground, and Mormon tea individuals are clearly visible on the more stable surface on the right side of the view. Netleaf hackberry trees are present on both banks, including one large and striking individual on the upstream side of the sandbar across the river.

Franklin A. Nims, 57-RS-77, courtesy of The National Archives

4 June 1993
The flow on this day was between 60,000 and 70,000 ft³/s. Based on Nims’s photo, Jim Braggs of the National Park Service estimated the flow of 1889 at about 40,000 ft³/s. Some of the driftwood lodged in the center front portion of this photo is still in place, but it is hidden behind a new netleaf hackberry tree. Trees and scrubs in general have increased, including singleleaf ash, hackberry, Fremont barberry, and skunkbush sumac; persistent needle-and-thread grass and Indian ricegrass are present; the shrub winterfat has persisted on the right side of the view; and a number of Mormon tea individuals look strikingly similar 104 years after the original photograph was taken. Non-native tamarisk are now present, obscuring the distribution of native netleaf hackberry. According to tree-ring analysis, the prominent hackberry tree on river right (left center) sprouted in 1802.

Robert H. Webb

31 July 2010
Some of the historic driftwood is still in place, although much of the pile has disintegrated, and some pieces can be seen through the netleaf hackberry tree, new in 1993 but now died back in the foreground. Many of the plants visible in 1993 are clearly visible and persistent in 2010, although the perennial grasses in general have decreased. The large hackberry that dominated the foreground 17 years previously has died back. The very old hackberry across the river has also died back but is still alive.

Steve Young
4 June 1889
This downstream view shows Rapid 5 in Cataract Canyon, essentially fast water at this discharge of about 40,000 ft³/s. Large netleaf hackberry trees are present along the river in the foreground, and many other trees are on both banks in the distance. The feathery looking shrubs along the rocky slope at left are winterfat, and numerous Mormon tea individuals are apparent in the same area. The distorted and out-of-focus object blocking the immediate foreground is probably the stage to Nims’ camera, which he uncharacteristically failed to lower before taking this image with his wide-angle lens.

Franklin A. Nims, 57-RS-69, courtesy of The National Archives

30 March 1994
The larger of the two obvious netleaf hackberry trees in the foreground has died, and a tree-ring analysis of the stump indicates the tree germinated around 1735. Other hackberry trees persist in the view, and new individuals are also apparent in the right foreground. A number of Mormon tea and winterfat individuals have persisted the 105 years between these views. The prominent sandbar on river right, submerged in 1889, is one of the two heavily used camping beaches below Rapid 5.

Steve Tharnstrom

31 July 2010
This view is slightly behind the original camera station but shows the same rocks, shrubs, and trees as the original and first match. The young netleaf hackberry individuals at right center persist from 1994 and have grown, and most of the individuals alive in 1994 are still alive throughout the view. Tamarisk on both sides of the river are dead or dying, although some individuals behind the beach on river right remain quite green and healthy looking. The sandbar on river right is smaller than it was in 1994, but this sandbar and others in Cataract Canyon undergo very large annual changes owing to deposition during the spring/summer flood and subsequent erosion during the summer and fall.

Steve Young
4 June 1889
This upstream view from river left shows the wall of a steep chute downstream from Rapid 5. The surface beyond the barren wall supports desert vegetation on a relatively stable slope, and several individuals of Mormon tea are apparent on that surface. Although the channel banks are mostly devoid of riparian vegetation, several netleaf hackberry are present on both banks.
Franklin A. Nims, 57-RS-64, courtesy of The National Archives

5 June 1993
In the intervening 104 years, a debris flow has deposited new boulders in the chute, and the wall has eroded back, exposing new rocks. Most of the Mormon tea individuals, however, persist on the steep surface. Russian thistle have established in the channel of the chute, and perennial grasses, notably Indian ricegrass, are present within the Mormon tea assemblage. Several netleaf hackberry persist in the view, and tamarisk and other native species, notably long-leaf brickellbush, are present along the shorelines. The water level is about 60,000 ft³/s, and water levels in the view show that the discharge is significantly higher than in 1889.
Robert H. Webb

31 July 2010
Discharge in the river is about 6,000 ft³/s, and the low water has exposed several sandbars, including the heavily used one downstream from Rapid 5 on the right side (center distance). Most of the Mormon tea persist, except one that was new on the chute wall in 1993, and snakeweed and rubber rabbitbrush have established in the chute channel. Netleaf hackberry individuals persist and newly established plants are apparent in the view, particularly on river left. Several dead tamarisk are visible in this view.
Steve Young
4 June 1889
This grainy photograph shows the reach downstream from Rapid 5 and the flimsy boats of the Brown-Stanton expedition pulled up in a little cove. The pile of boulders is from a debris flow out of a small gully to the left that occurred at some unknown time before this expedition arrived. The line of netleaf hackberry on river right shows up prominently against the boulders and sand, and a couple of hackberry trees can be discerned in the shadows on the left.
Franklin A. Nims, 57-RS-53, courtesy of The National Archives

23 July 1992
A debris flow has altered the foreground and pushed the river banks to the right, leading to the creation of a new sandbar that the boat is parked against. Across the river, the major camping beach below Rapid 5 is prominent below the line of netleaf hackberry trees, more than ten of which are persistent. Several other hackberry trees on the left side also persist, and new individuals are noticeable in the immediate left foreground. Finally, Mormon tea on the left slope persist the intervening 103 years.
Gary B. Bolton

31 July 2010
The sandbar is much larger owing to seasonal variation in bar building and destruction. One of the foreground tamarisk trees (left) appears to be dead and the other (right) has been partially defoliated by tamarisk leaf beetles. Similarly, dead tamarisk trees appear on the sand bar across the river, standing in contrast with the netleaf hackberry trees that continue to persist. In the foreground, several short-lived species, notably rubber rabbitbrush, have persisted the intervening 18 years despite a regional drought.
Steve Young
6 June 1889
After their arduous portages in the rapids upstream, the Brown-Stanton Expedition decided to spend most of the day in the cottonwood grove on river left at Tilted Park. They needed to dry their equipment after the wreck of the Brown Betty. The crew members began to question Frank Brown’s leadership at this point in their expedition, and it was here that they decided to split the expedition in half. In this upstream view, Franklin Nims captures a beach devoid of vegetation except for scattered cottonwood seedlings, and driftwood logs are present.

Franklin A. Nims, 57-RS-58, courtesy of The National Archives

24 July 1992
Tamarisk has invaded the formerly barren sandbars at Tilted Park. Some other Nims photographs from this site are totally blocked by tamarisk thickets. The cottonwood seedlings in 1889 apparently did not persist as they were established at a site vulnerable to flooding, and driftwood is scattered around the open sand but is wrapped around the tamarisk to the right. Coyote willow and scattered tamarisk trees line the left side of the view. Hackberry in the background on river left have increased, but junipers appear to be in the same positions on the slopes above.

Gary B. Bolton
6 June 1889
As the Brown-Stanton Expedition continued downstream, Franklin Nims made another upstream view of Tilted Park. John Wesley Powell named Tilted Park for the prominent rotated Toreva blocks, the toes of which appear behind the cottonwood trees on river right. The view is across Rapid 10, which has no discernible waves at this high discharge of about 40,000 ft³/s. Desert vegetation appears on the rocky slope here.

Franklin A. Nims, 57-RS-60, courtesy of The National Archives

24 July 1992
In the foreground, eight individuals of Mormon tea persist while five have died. Individuals of other species, notably winterfat, have also persisted. Well-developed biological soil crusts appear in both the 1889 and 1992 views. Across on river right, tamarisk and coyote willow form a dense thicket with cottonwood trees appearing behind. Fremont cottonwoods have died on both sides of the river at Tilted Park. The camping beaches here appear to be larger, possibly because tamarisk has stabilized the banks on the right side of Rapid 10.

Gary B. Bolton

31 July 2010
There has been little change in the intervening 18 years between photographs in the beaches, plants, and biological soil crusts, but major changes have occurred in the riparian thicket on river right across Rapid 10. The dead or dying non-native tamarisk trees now clearly can be distinguished from the coyote willow and other native species. Many of the individual plants that were present in 1992, including Mormon tea and winterfat, continue to persist, and the dense biological soil crusts distinguish the intershrub spaces.

Steve Young
6 June 1889
The Brown-Stanton Expedition paused at this site to dry their gear and reload boats before rowing down a quiet stretch now informally called “Lake Cataract.” This downstream view shows coyote willow on a long sandbar.
Franklin A. Nims, 57-RS-62, courtesy of The National Archives

30 March 1994
The channel of the Colorado River has shifted more than 200 feet to the right of the former camera position. Debris flows from tributaries just upstream and at Rapid 12 constricted the river upstream and downstream from this camera station and moved the river channel away from the former beach. The camera position in 1994 is too low because the surface of the former beach has lowered. The coyote willow on the former river banks has been replaced with non-native tamarisk and native rabbitbrush, four-wing saltbush, desert olive, and prince’s plume. One new cottonwood is obscured behind the dense vegetation.
Steve Tharnstrom

12 June 2002
Although some of the rubber rabbitbrush in the foreground have died back, revealing more of the background, little real change has occurred in this view in the intervening 8 years.
Dominic Oldershaw
Mile 207.0, Rapid 12, Downstream View from River Left (Stake 3069)

6 June 1889
Franklin Nims often climbed to capture long views of the canyon, as exemplified by this downstream view across from Rapid 12. The river is at a discharge of about 40,000 ft$^3$/s. To reach this camera station, Nims and his assistant had to walk up a gypsum plug through dense biological soil crusts. Their trail to the camera station appears in the foreground.
Franklin A. Nims, 57-RS-63, courtesy of The National Archives

5 June 1993
The river is flowing at about 70,000 ft$^3$/s, which is considerably higher than the level in 1889. There are nine persistent Mormon tea plants, seven persistent shadscale, two new cottonwoods, and many non-native tamarisks. The trail Nims probably started is also apparent in the foreground of this view and is still used by river runners to access and interpret the low anhydrite dome. The channel of the unnamed tributary at the base of the hill is now braided because of debris-flow activity. New debris flows from the canyon at Rapid 12 have deposited many large boulders in the lower left and center parts of this view. The island that previously was in the eddy below Rapid 12 has become attached to the bank because the eddy at lower left that appears in
7 June 1889
This upstream view shows the mouth of an unnamed canyon that some call False Range because some who aren’t well acquainted with Cataract Canyon might confuse it for the real thing after the long row across what is known as Lake Cataract. This view show desert and riparian vegetation in this reach, including a line of netleaf hackberry trees. As was often the case, Nims took both an upstream and a downstream view from one location (see Stake 1785a).
Franklin A. Nims, 57-RS-66, courtesy of The National Archives

24 July 1991
There is little change in the foreground hillslope over the past century. As a result, numerous persistent desert shrubs can be identified, especially Mormon tea and desert barberry. Several netleaf hackberry trees persist along the left bank (closest to the camera station). Dense to scattered tamarisk has become established along the near and far bank, as well as the less obvious coyote willow and other native riparian species.
Ted Melis

1 August 2010
Summer rainfall at the time of this match caused a small flash flood in False Range Canyon, and the Colorado River is red from local sediment injected upstream by other little floods. Mormon tea and desert barberry continue to persist, and individuals of other species, notably rubber rabbitbrush, persist over the last 19 years. Netleaf hackberry trees persist, and new plants were observed in this reach but are too small to be clearly visible in this match. Tamarisk is dying because of the tamarisk leaf beetle, and native riparian species are increasing along both shorelines.
Steve Young
Mile 205.0, Opposite Range Canyon, Downstream View from River Left (Stake 1785a)

7 June 1889
This downstream view is across the head of Rapid 13, the most minor of the rapids in the Mile Long Rapid complex. A discharge of around 40,000 ft³/s covers the extensive debris fan extending out from the mouth of Range Canyon, which appears on the extreme right side across the river. The desert vegetation in the foreground consists mostly of Mormon tea with scattered desert barberry and perennial grasses. A clump of hackberry trees is visible at right center. As was often the case, Nims took both an upstream and a downstream view from one location (see Stake 1785b).

Franklin A. Nims, 57-RS-78, courtesy of The National Archives

24 July 1991
Numerous Mormon tea persist, as do individuals of several species of perennial grass and at least two individuals of desert barberry. Several netleaf hackberry trees that line the left side of the river persist, new individuals have grown up, and what may be a new line of coyote willow, mixed with non-native tamarisk, appears just downslope. The blackened soil surface in the left foreground are biological soil crusts, which appear in the same location as a blackened surface in the grainy 1889 view.

Ted Melis

1 August 2010
Little has changed in the desert vegetation of this view, although several perennial grass clumps have died. The netleaf hackberry trees mostly persist with many new individuals present but not visible in the view. Dead and dying tamarisk trees stand in contrast to the thriving netleaf hackberry trees upslope of the Range Canyon debris fan. The biological soil crust in the left foreground appears to be more prominent, but this could partially be explained by recent summer rainfall.

Steve Young
8 June 1889
Franklin Nims took this view to show the proposed railroad route on the left side of Cataract Canyon in Mile Long Rapid. The photograph shows one of the numerous tributary channels that enter the Colorado River in this reach, and one of the most dangerous rapids – Rapid 15 or Capsize Rapid – is just visible upstream in a little bend. Numerous Mormon tea are growing within the rocky debris fan, and netleaf hackberry trees grow along both shorelines.
Franklin A. Nims, 57-RS-42, courtesy of The National Archives

31 March 1994
The most striking feature of this photo match is the lack of change in desert vegetation over the intervening century. Eighteen Mormon tea plants are still present from the time that Nims took his photo and only two new ones were found. The number of netleaf hackberry trees has increased from two to five, a typical increase in the fast-water section of Cataract Canyon. Most of the rocks in the view are unchanged.
Steve Tharnstrom

1 August 2010
The desert vegetation continues to show little change despite the prevailing drought conditions of the previous decade. Many Mormon tea plants persist along with some desert barberry, and several rubber rabbitbrush persist over the previous 16 years. Although most of the netleaf hackberry trees persist, one of them, just to the left of the two figures in the center of the photo, has died. The tamarisk at left center is either dying or dead due to tamarisk leaf beetles.
Steve Young
8 June 1889
This downstream view unfortunately has considerable damage to the original emulsion that resulted from problems with the paper-stripping negative. The Button, a landmark that heralds the Big Drop series of rapids, appears on the right-center skyline. Although some whitewater from the tailwaves of Rapid 17 appear in the river, this view mostly shows considerable desert vegetation and a line of netleaf hackberry on the left bank of the river.
Franklin A. Nims, 57-RS-80, courtesy of The National Archives

24 July 1992
The above-river landscape is extremely stable, with numerous Mormon tea and netleaf hackberry persistent in the view. Tamarisk has joined the hackberry in forming a near-continuous but narrow line of riparian vegetation in this reach. Numerous clumps of perennial grasses are present in the foreground.
Steve Tharnstrom

1 August 2010
The Mormon tea and netleaf hackberry generally persist, but the tamarisk is mostly dead owing to the impact of the tamarisk leaf beetles. Some perennial grasses, notably needle-and-thread, have persisted the intervening 18 years despite a severe regional drought.
Steve Young
8 June 1889
The Brown-Stanton Expedition portaged their boats down the left side through most of Mile Long Rapid (Rapid 13 to 19). Rapid 18 is at the downstream end of Mile Long and forms a substantial navigation hazard. For example, in 1909 Seymour Dubendorff of the Stone Expedition flipped his boat at the top, probably on or near the rocks and waves shown in this downstream view. On the lower left side of the rapid, the Button Hole flips many unwary boatmen in medium flows (about 30,000-45,000 ft³/s).
Franklin A. Nims, 57-RS-68, courtesy of The National Archives

31 March 1994
The large boulder that now blocks the view came from an isolated rockfall, which is common throughout Cataract Canyon. Although this photographic evidence is not conclusive, we believe from other evidence that the Button Hole formed in the 20th century as a result of one of these isolated rock falls.
Steve Tharnstrom
8 June 1889
This downstream view from river left shows the rocky debris fan in middle of Rapid 19, the last primary rapid in the Mile Long Rapid complex. This view primarily shows desert vegetation, netleaf hackberry along the shoreline, and what appears to be a dead tree in the center of the grainy view.
Franklin A. Nims, 57-RS-52, courtesy of The National Archives

24 July 1992
The dead tree is a Utah juniper that is still standing. A radiocarbon sample taken from this tree suggests it died 200-250 years ago. Other dead juniper snags are in this reach, and several live Utah junipers are present, including one behind the dead tree. What is not obvious in the 1889 view is that several single-leaf ash trees were present and persist. Several Mormon tea persist as well. The netleaf hackberry, seen as a line in the midground, mostly persist, and tamarisk trees are present, most notably above the sandbar in the right foreground.
Gary B. Bolton

1 August 2010
The dead Utah juniper is still standing, and the most dramatic change in the view is the dead or dying tamarisk that have been killed by tamarisk leaf beetles. Numerous seedling netleaf hackberry are present within the line of riparian trees, suggesting the possibility that this native species may replace tamarisk. Short-lived desert species, including rubber rabbitbrush and some perennial grasses, have persisted the intervening 18 years despite severe drought conditions.
Steve Young
9 June 1889
This downstream view from river left shows the large camping beach above Big Drop 1 and the mouth of Teapot Canyon across the river on the right. This sandbar collects considerable driftwood, as shown in the right foreground. The camera station is on an unstable slope, which helps to explain why the two matches are slightly off. Two individuals of Mormon tea are in the left foreground, and a line of netleaf hackberry trees lines the back of the beach.
Franklin A. Nims, 57-RS-70, courtesy of The National Archives

24 July 1992
The beach appears larger because the water level is much lower in the match, and the line of driftwood is at a lower water stage. The line of netleaf hackberry has changed as a result of some mortality and recruitment, and tamarisk now is prominent in the line of riparian trees. Although the match appears to be too far into the view, one of the Mormon tea individuals has persisted the intervening century. One of the most notable changes in the view is not obvious; a huge pile of driftwood is on the debris fan extending from the mouth of Teapot Canyon. This driftwood accumulated during the 1983-1984 floods and has considerable modern trash within its mass.
Steve Tharnstrom

1 August 2010
The two Mormon tea individuals alive in 1889 still persist 121 years later, looking very much the same. Few changes have occurred in the line of netleaf hackberry trees, but the tamarisk trees are dead and dying courtesy of the tamarisk leaf beetles. The driftwood line has moved back upslope, reflecting the effects of the flood the previous spring.
Steve Young
Mile 198.5, Upstream of Waterhole Canyon, Upstream View from River Left (Stake 3382)

11 June 1889
The Brown-Stanton Expedition encountered a sizeable rapid upstream from Waterhole Canyon, which Franklin Nims captured in his upstream view despite the fact that it did not show the proposed railroad route. In the 1940s, Harry Aleson called this a fun rapid, and during his 1896 run George Flavell developed his call of joy here—“Whoops! Aha!”

Franklin A. Nims, 57-R5-41, courtesy of The National Archives

27 March 1997
Lake Powell began to fill in March 1963, and this rapid was covered by the still waters in 1980. Several of the large boulders are still present in the midground. Across the reservoir, at least one Mormon tea persists from 1889. Note the tamarisk and lake deltaic sediments that are ubiquitous in this reach.

Robert H. Webb
For Stanton’s crew, the objective on the morning of December 23 was not just to survey a railroad route but to reach Lee’s Ferry in time for Christmas. They knew that Warren Johnson lived at Lee’s Ferry and expected a feast, a departure from their spartan river fare. They had camped the previous night only a short distance above the current site of Glen Canyon Dam. At 8:30 AM, Stanton stopped in a right-hand bend 14.7 miles upstream of Lee’s Ferry. While others surveyed the route, Nims captured this view under cloudy skies.

Franklin A. Nims, 57-RS-235, courtesy of The National Archives

In October 1956, the blasting began on the walls of Navajo Sandstone at this once obscure spot. In 1963, Glen Canyon Dam was completed and Lake Powell began to fill. At this point, about one-half mile downstream, a new horizontal stripe on the wall was created by seepage from the reservoir. The small sand bars that lined the banks of the Colorado River in 1889 have eroded away, although a large sand bar is present directly across the river from the camera station.

Robert H. Webb

In the 19 years between photographs, the vegetation growing along the shoreline has increased in both size and stature, particularly the netleaf hackberry. Many of the individual plants persist, and a new netleaf hackberry is visible in the lower right corner of the image.

Robert H. Webb
23 December 1889
While the Brown-Stanton expedition would eventually switch from an instrument survey to a purely photographic survey of the canyons of the Colorado River in order to save time, at this point, they were still conducting an instrument survey. Three members of the expedition, with plane table and stadia rod, are visible in the center foreground. Shrubs, likely Mormon tea and saltbrush, grow upon the slope in the foreground, while the river’s edge is barren.
Franklin A. Nims, 57-RS-236, courtesy of The National Archives

29 October 1992
A century later, the presence of Glen Canyon Dam, which is just upstream, affects this view and all others downstream that show the river corridor. Large power poles dominate the skyline, a small power line crosses in the midground, and riparian vegetation, mostly netleaf hackberry and non-native tamarisk, has become established along the river corridor now protected from large floods. The shrubs growing along the slopes include Mormon tea, sand sagebrush, grizzlybear pricklypear, and non-native Russian thistle. A small area of biological soil crust is apparent at lower left.
Robert H. Webb

20 April 2011
The netleaf hackberry have increased in both stature and number of individuals in the ensuing two decades, and the tamarisk visible along the opposite bank has increased as well. Many of the Mormon tea persist, while some of the four-wing saltbush and sand sagebrush have died, as has the grizzlybear pricklypear. The biological soil crust is still present albeit subdued, and the large boulder in the center foreground has rotated.
Robert H. Webb
Mile 13.5, Opposite Ropes Trail, Downstream View from River Left (Stake 2600)

23 December 1889
This striking view on an overcast day captures an image of a steep slope leading into a river bend. Three members of the expedition are visible in the lower right corner of this image, while a heavily vegetated slope dominates the foreground. The plants include rubber rabbitbrush, Mormon tea, and four-wing saltbush.
Franklin A. Nims, 57-RS-238, courtesy of The National Archives

11 June 1975
This photograph is a partial view of the original, and the rest of the images were not cropped down to this field of view. A thick stand of netleaf hackberry now grows in the center of the image, and the shoreline is dense with non-native tamarisk. Some of the Mormon tea, rubber rabbitbrush, and four-wing saltbush have persisted the eight decades between images.
Raymond M. Turner

10 February 1992
This image shows the same field of view as the 1889 image. A large four-wing saltbush appears in the left foreground. Many of the same Mormon tea and four-wing saltbush persist since 1889, and non-native Russian thistle is now present on the slope. The neatleaf hackberry stand in the center of the image, and the tamarisk growing along the shore are leafless in the winter season.
Ted Melis
20 April 2011
Most of the four-wing saltbush, including the individual in the left foreground, have died, while the Mormon tea and rubber rabbitbrush largely persist. The netleaf hackberry and tamarisk, which are fully leafed out, appear to have increased in size.

Bill Lemke
23 December 1889
Standing on a talus slope, Nims captured this view overlooking a dense tangle of Mormon tea in the foreground, large boulders in the midground, and a long sweep of sandy beach on the opposite bank. A line of tall shrubs, likely coyote willow or desert olive, grow behind the sandbar. The trees growing along the left bank in the midground appear to be netleaf hackberry trees.

Franklin A. Nims, 57-RS-237, courtesy of The National Archives

11 June 1975
This photograph, taken 86 years after the first photograph and a dozen years after completion of Glen Canyon Dam (about a mile and a half upstream), shows only the center part of the original view; the other images have not been cropped down to the field of view in 1975. Many of the same large boulders are visible on the slope in front of the camera station. The long sandbar on river right has eroded, a common effect of dam operations. A thick growth of riparian vegetation, including netleaf hackberry and non-native tamarisk, lines the river corridor; some of the former may persist from 1889. A line of new talus cones—remnants of dam construction—are visible in the center of the image.

Raymond M. Turner

19 December 1989
The stage of the large-format camera has not been lowered and is part of this wide-angle view. In 1983 and 1984, large releases of water from Glen Canyon Dam scoured the river channel downstream. Tamarisk and netleaf hackberry have regained their foothold along the banks in this reach. Some of the Mormon tea that are visible in the 1889 image persist, and four-wing saltbush and rubber rabbitbrush have become established on the midground slope.

Raymond M. Turner
29 October 1992
Few changes are visible in the ensuing three years. The tamarisk and hackberry, which are leafed out in this image, appear to be larger than in 1989.
Tom Wise

20 April 2011
The riparian vegetation appears to have increased in size, with many of the same individual plants still visible. There has been some turnover in the four-wing saltbush, while the rubber rabbitbrush and Mormon tea have persisted and increased in size. A small flood has changed the tributary channel in the center foreground, and a thick growth of non-native red brome is visible in the lower right corner of the image.
Bill Lemke
Mile 12.3, Colorado River, Downstream View from River Left (Stake 753)

23 December 1889
From the same location on a talus slope where he captured an upstream view (Stake 754), Nims took this downstream view overlooking loose boulders in the foreground and a wide, barren sandbar in the distance. Sandbars such as this one created navigational hazards for boatmen plying these waters before flow regulation. Pockets of driftwood are nestled among the boulders, and a crew member lounges near the shore. The vegetation on the slope is likely four-wing saltbush.
Franklin A. Nims, 57-RS-240, courtesy of The National Archives

11 June 1975
This photograph captures the central portion of Nims’ original image; the others have not been cropped down to the same field of view. The foreground has changed dramatically, and none of the same foreground boulders are discernible; only the background indicates the camera station is in the right location. Tamarisk grows densely near the riverbank, and small shrubs, likely four-wing saltbush, are also visible.
Raymond M. Turner

19 December 1989
This image was taken in a slightly different location than the 1975 view, but many of the same plants and boulders are readily identifiable. The leaflessness of the tamarisk permits a glimpse at the sandbar in the distance, which appears to be slightly smaller in area than it was in 1889 but higher in elevation away from the river. Biological soil crust is visible on the foreground slope, as is four-wing saltbush and Mormon tea.
Raymond M. Turner
21 April 2011
Two decades later, many of the foreground tamarisk have died back. Several new netleaf hackberry have become established, and there is a fair amount of vegetation growing on the distant sandbar. The biological soil crust persists, as does some of the Mormon tea; there has been die off and replacement of the four-wing saltbush. Pepperweed and globemallow are now abundant.

Bill Lemke
23 December 1889
From a rocky talus slope, Nims captured this view of a bend in the river with a large sandbar along the right bank. He was standing approximately at the top of the old high-water zone, an area of bank swept clean of vegetation by pre-dam floods. A large netleaf hackberry is visible at right center. The shrubs in the foreground may be Mormon tea. The image was taken from the same camera station as Stake 753.
Franklin A. Nims, 57-RS-239, courtesy of The National Archives

11 June 1975
This view captures only the central portion of Nims’ original; the other images have not been cropped down to this field of view. Tamarisk is now growing on both sides of the river corridor, including on the formerly barren sandbar. Bare talus cones, remnants of dam construction, are now present in the center of the image, and two large power poles are visible on the top of the cliffs.
Raymond M. Turner

19 December 1989
Raymond M. Turner This image, which more completely matches Nims’ view, was flashed during development, but some information can still be determined. In addition, the camera stage has not been lowered and appears at the bottom of this wide-angle image. The tamarisk is leafless in the winter season, but appears to be similar in cover to that of 1975, in spite of scouring during the 1983 and 1984 high-flow releases. Foreground vegetation include netleaf hackberry, longleaf brickellbush, pepperweed, and four-wing saltbush.
Raymond M. Turner

21 April 2011
Netleaf hackberry and four-wing saltbush dominate the foreground of the view, and pepperweed has increased considerably. Many of the tamarisk appear to have died back. A boat is anchored where the sandbar once was emergent along the left shoreline.
Bill Lemke
23 December 1889
Nims captured this striking view from a talus slope covered with eolian sand; a similar slope is visible on the opposite shore at the base of the large cliff. Nowadays, views of this bend and others nearby taken from the rim appear on calendars and other media promoting the scenic vistas of canyon country. The dense collection of shrubs includes Mormon tea, grizzlybear pricklypear, and four-wing saltbush.
Franklin A. Nims, 57-RS-242, courtesy of The National Archives

10 February 1992
A century later, the height of the sand dune visible on the opposite shore has increased dramatically, likely deposited by large floods between 1890 and 1923. Tamarisk is now present here, growing in dense rows along the shoreline. Several individuals of Mormon tea persist, while the pricklypear has died. Four-wing saltbush is still growing in the area, although none of the original plants persist. Other vegetation growing on the slopes includes globemallow and rubber rabbitbrush; and biological soil crust is common.
Ted Melis

21 April 2011
Many of the four-wing saltbush have died off in the two decades between photographs, and the amount of biological soil crust has declined. The Mormon tea to the left of the boulder persists, and tamarisk is still abundant in the view.
Bill Lemke
23 December 1889
Rotating his camera slightly downstream, Nims took another vertical shot at Ferry Swale (see Stake 2602a). The eolian sand in the foreground and across the river is heavily vegetated with a variety of shrubs, including four-wing saltbush and Mormon tea. Low vegetation above the river on the opposite bank could include coyote willow and arrowweed; a single netleaf hackberry tree appears in the distance above the other shrubby riparian vegetation.
Franklin A. Nims, 57-RS-242, courtesy of The National Archives

10 February 1992
The amount of sand against the cliff on the opposite bank has increased significantly, while the lower sand bar has deflated. The small gully in the foreground has eroded, removing much of the original vegetation. The patch of Mormon tea in the right foreground persists, and four-wing saltbush and biological soil crust are present, along with a rubber rabbitbrush in the lower right corner. Non-native tamarisk grows in dense patches along the banks. The sand bar on the opposite shore is now part of the Ferry Swale Day Use Area, and two privies can be seen at center right.
Ted Melis

21 April 2011
Erosion has continued in the foreground gully, and many of the four-wing saltbush have died off. Many Mormon tea have persisted, but the amount of biological soil crust has declined. Pepperweed is now growing in the bottom of the gully, and the rubber rabbitbrush has died. Netleaf hackberry has become established against the cliff on the opposite shore, and the amount of tamarisk on both sides of the river appears to be similar to that present 19 years before.
Bill Lemke
Mile 7.0, Colorado River, Upstream View from River Right (Stake 751)

24 December 1889
This view is within the old high-water zone, swept clear of woody riparian vegetation by annual floods in the Colorado River. Nims’ footprints lead across the sand bank in the foreground to the boats, somewhere out of view in this upstream image. Only a few small shrubs can be seen near the camera station, but the opposite shore supports a dense stand of vegetation, possibly arrowweed. This upstream view was taken from the same point as Stake 752.
Franklin A. Nims, 57-RS-243, courtesy of The National Archives

11 June 1975
In this partial view of the original, an unidentified assistant holds branches of a tamarisk tree to minimize blockage of the center of the image. Tamarisk, arrowweed and coyote willow are abundant. The other images have not been cropped down to this field of view.
Raymond M. Turner

19 December 1989
Raymond M. Turner The dense vegetation that blocked the view 14 years earlier has either died back or been scoured out, possibly by the high flows in 1983 and 1984, but the tamarisk on the opposite shore remains dense. The tamarisk at upper left is leafless in the winter season. The stage of the large-format camera has not been lowered out of this wide-angle view.
Raymond M. Turner

21 April 2011
Steve Tharnstrom Seepwillow, a native woody riparian species, blocks most of the view of the river from this camera station, and peppergrass and non-native red brome grass contribute significant ground cover. The tamarisk on the opposite shore, largely blocked from view by the seepwillow, persists; the tamarisk at left center appears to have died.
Steve Tharnstrom
Mile 7.0, Colorado River, Downstream View from River Right (Stake 752)

24 December 1889
Nims took this downstream view from the shore of the river, below an active cutbank in the old high-water zone. The plants growing on the top of the steep bank are likely arrowweed. This image was taken from the same camera station as Stake 751.
Franklin A. Nims, 57-RS-244, courtesy of The National Archives

11 June 1975
Eight decades later, a dense tamarisk thicket blocks most of the downstream view from this camera station, making occupation of the original extremely difficult and imprecise. This photograph shows only the central portion of the original, and the other images were not cropped down to the same field of view.
Raymond M. Turner

19 December 1989
This image more fully matches the original, as can be determined strictly from the skyline; the view is mostly blocked by tamarisk. Arrowweed and coyote willow are also present, particularly on the right side and the top of the bank.
Raymond M. Turner

21 April 2011
The leaves on the tamarisk obscure more of the view, but overall it appears to be similar to conditions in 1989. Coyote willow is still present. Seepwillow, pepperweed, wild rye, fescue, and red brome are now also in the view.
Steve Tharnstrom
**Mile 3.5, 3-Mile Bar, Upstream View from River Left (Stake 2603a)**

26 December 1889

Nims photographed this upstream view to show the type of excavation in cliffs that would be required to construct a railroad through the lower parts of Glen Canyon. The slope on which the camera is stationed is partially covered with shrubs, but frequent floods prevent vegetation from becoming established on the large sand bar on river right.

Franklin A. Nims, 57-RS-246, courtesy of The National Archives

11 February 1992

As a result of livestock grazing, vegetative cover has decreased, notably with perennial grasses. A pricklypear remains in the center foreground, and more individuals of this species have appeared on the slopes. The sand on the right bank has been eroded, but the sandbar in the river bend has been changed very little despite some colonization by riparian vegetation. Rockfalls and slides have occurred on the right side of the view, depositing more scree and talus the foot of the walls.

Tom Wise

20 April 2011

Riparian vegetation on the sandbar has increased, notably at the edge of the river where tamarisk, pricklypear, Russian knapweed, and Mormon tea persist. The amount of vegetative cover on the slope at right is about the same. In front of the camera station, three pricklypear individuals and a Mormon tea persist from 1992.

Steve Tharnstrom
Mile 3.5, 3-Mile Bar, Downstream View from
River Left (Stake 2603b)

26 December 1889
This downstream view is from a steep-angled talus cone on the left side of the Colorado River in Glen Canyon. This talus cone is covered by stabilized eolian sand, but rocks protrude through it. The high-water mark on the sandbar across the river is clear in this view; the vegetation stops abruptly and bare sand continues to the river. On the left side, sparse riparian vegetation occurs near water level, and the slope has individuals of Mormon tea and grasses.
Franklin A. Nims, 57-RS-247, courtesy of The National Archives

11 February 1992
Livestock trails crisscross the slope, and grazing appears to have decreased the number and coverage of perennial grasses. A new rill cuts into the slope in the center foreground; erosion on the slope may have increased as a result of the loss of cover. Across the river, the bare sand has mostly been eroded away and vegetation has established to the water on the point of the sandbar. In the left foreground, three Mormon tea plants persist from 1889. The prickly pear in the bottom left corner of the foreground is new, as are two Russian knapweeds downslope near the water. Another small but notable change is that the pointed rock at the center-left edge has broken off.
Tom Wise

20 April 2011
Even less sand is visible on the right bank, and riparian vegetation has become densely established to water level. In the foreground, three individuals of pricklypear and four of Mormon tea persist, as well as the two individuals of the non-native Russian knapweed in the center.
Steve Tharnstrom
26 December 1889
This view up Fall Canyon was taken to illustrate the bridge crossing that Stanton had to design to allow his railroad to course down the left side of the river corridor. The canyon floor is relatively smooth, a result of large volumes of stormwater runoff coming off the Echo Cliffs and running to the Colorado River behind the camera station. Most of the vegetation in this view is on the canyon floor, though the foreground ledge hosts grasses and a few shrubs.
Franklin A. Nims, 57-RS-248, courtesy of The National Archives

11 February 1992
The canyon floor has become channelized, and the channel has moved toward the rock overhang and the camera station. Perhaps as a result, the lip of the ledge has broken away. A large rock at the right center edge has also broken and slipped down to the foreground ledge. The two shrubs in the right foreground have died, but two individuals of Mormon tea persist on the center-right ledge and on the foreground ledge. Grasses remain on the foreground ledge but have been grazed by livestock. New plants include rubber rabbitbrush and three pricklypear near the lip of the ledge, four-wing saltbush at the right-center edge of the view, tamarisk on the canyon floor, and netleaf hackberry at the foot of the opposite canyon wall.
Ted Melis

20 April 2011
The three pricklypear on the foreground ledge persist from 1992 and have increased in size. The Mormon tea individuals in this area also persist since 1889. The tamarisk, netleaf hackberry, and Russian knapweed remain on the canyon floor, and the entire canyon is more heavily vegetated with only small patches of exposed sand. The channel in the canyon remains in the same place.
Steve Tharnstrom
26 December 1889
The Stanton expedition reached Lee’s Ferry (mile 0.0) for the second time on December 23, 1889, after a hard row against an upstream wind. The following day, crew members rowed back into Glen Canyon to complete their instrumental survey of the railroad route. Nims did not take notes as thoroughly as Stanton; he probably made this downstream view in Glen Canyon on the afternoon of December 24. Although Stanton states that the day was “clear and beautiful,” the photograph shows partly cloudy skies. Although the river corridor is mostly devoid of riparian vegetation, desert vegetation – notably blackbrush – appears on the ledge in the foreground.

Franklin A. Nims, 57-RS-250, courtesy of The National Archives

11 June 1975
The beach in the lower right has eroded back into a cove and has been mostly colonized by riparian vegetation, both native and non-native species. Downstream, the sandbar on the left has also been obscured by riparian vegetation. The blackbrush on the ledge persist, pricklypear is new to the foreground.

Raymond M. Turner

20 December 1989
Vegetation on the beach has decreased in response to sustained high-water releases from Glen Canyon Dam in the mid-1980s, but the sand itself has been eroded further, creating a cove where the boat is parked. The blackbrush individuals in the foreground persist.

Raymond M. Turner

28 October 1992
Tom Wise replicated Nims’ view on a cloudy day at 2:25PM. The most obvious changes are the erosion of the sand bar at the lower right and the increase of tamarisk at left center. Few changes have occurred in the blackbrush-dominated vegetation in the foreground; all eight individuals of blackbrush survived the intervening 103 years despite livestock grazing; only one became established in the past century. Pricklypear has increased in density. The line at left center is Stanton’s road, built in 1899 as assessment work to validate upstream mining claims; rocks displaced from the road appear at bottom left.

Tom Wise
26 December 1889
This camera station, upstream from Lee’s Ferry, represents the last photographs Franklin Nims took before the Stanton expedition reached what passed for civilization at Lonely Dell Ranch on the Paria River. This upstream view is from a low bedrock terrace on the left side of the Colorado River. This slope is sparsely dominated by blackbrush and Mormon tea. Interestingly, footprints are apparent in the soil leading up to the camera station. In the mid-1890s, Stanton returned to this area to build a road to his mining claims on river terraces in Glen Canyon.
Franklin A. Nims, 57-RS-250, courtesy of The National Archives

11 June 1975
This first match is only a partial view of the original wide-angle photograph. Rocks are piled in the right foreground from Stanton’s road, which cuts through the lower right corner of the view but largely spares the camera station. The Mormon tea that was previously at lower right was killed, but seven blackbrush persist from 1889 and two new individuals have become established. A pricklypear has become established in the center of the foreground.
Raymond M. Turner

28 October 1989
This second match is partial and slightly off the original camera station. Blackbrush continues to persist in this view, but no new individuals have become established. The Mormon tea and prickly pear in the center of the foreground have died. There are four new narrowleaf yuccas in the midground, and a new turpentine bush appears in the lower left corner. Farther upstream, the right riverbank has become more heavily vegetated with non-native tamarisk while the left side has less vegetation.
Raymond M. Turner
28 October 1992
The near shoreline remains unchanged, but riparian vegetation has increased in density upstream, particularly on river left (right side at center). Phragmites are apparent along the river banks, and a mix of native and non-native woody species are further back from the river. Blackbrush, prickly pear, turpentine bush, and Mormon tea continue to persist, although two Mormon tea individuals have died in the foreground. Snakeweed and narrowleaf yucca have established in the view, and the yuccas have been grazed, probably by cattle or horses, and cattle dung appears in the view.
Tom Wise

21 April 2011
Along the upstream banks on both sides of the Colorado River, riparian vegetation has become established to the water edge where sand was exposed in earlier matches. Indian ricegrass, dropseed, shadscale, and shrubby coldenia have colonized the roadway, which does not appear to be have more use than as a cattle path. Woody aster is new to the view. The blackbrush and Mormon tea populations appear stable with many persistent individuals; no blackbrush and only one Mormon tea have died. Three of the narrowleaf yuccas have died during recent drought years, and one narrowleaf yucca has become established and then died in the last 19 years as well.
Steve Tharnstrom
25 December 1889
The members of the Brown-Stanton Expedition celebrated Christmas at Lee’s Ferry next to one of the stone fort buildings that is known as the Lee’s Ferry Fort. Stanton is seated at the head of the table at the left. The river is visible behind the crew in the distance.
Franklin A. Nims, 57-RS-268, courtesy of The National Archives

17 January 1990
Prior to launching on a trip to replicate views taken by Nims and Stanton, Bob Webb’s crew posed for a match of the Nims Christmas dinner image. From left to right: Bob Webb, Jack Schmidt, Ted Melis, Drifter Smith, Mimi Murov, Rosalee Winn, Tom Brownold, Ralph Hopkins, Tom Wise, and Glenn Rink. The shrubs in the midground are four-wing saltbush, and tamarisk lines the banks of the river. The match is slightly off owing to changes in the camera station.
Robert H. Webb

15 September 2010
Twenty years later, Webb once again posed his repeat photography crew next to the Lee’s Ferry Fort. From left to right: Bob Webb, Erica Unhold, John Mortimer, Steve Tharnstrom, Lindsay Smythe, Clavey Wendt, Jayne Belnap, Mike Scott, Steve Kinney, and Todd Esque. Most of the four-wing saltbush have increased in size, there are some new four-wing saltbush in the midground, and trees – mostly tamarisk – block the view of the river.
Bill Lemke
28 December 1889
The mouth of the Paria River meanders toward the Colorado and extends a sandy delta with braided channels into current. Vegetation is sparse along the main channel of the Paria but is denser along the Colorado River shoreline, notably in the right mid-center. This shrubby vegetation likely is mostly arrowweed, although other species also may be present. Cottonwood trees did not grow along the river but occurred upstream along the Paria River, particularly around Lonely Dell Ranch, marked by the dense grove of cottonwood in the distance at left center.

Franklin A. Nims, 57-RS-261, courtesy of The National Archives

20 December 1989
The mouth of the Paria River shifted downstream around 1912, and the former river channel was walled off by sediment deposited by the Colorado River. This new river terrace has been modified to accommodate a long-term parking lot and river access on the floodplain. With the erosion of this part of the debris fan, woody riparian vegetation has advanced up Paria River canyon. Tamarisk had become established here by 1938. There are powerlines and an access road cutting off the base of the talus slope on the right side of the shore.

Raymond M. Turner

21 April 2011
A line of Fremont cottonwood, coyote willow and black willow have been planted along the shoreline. Tamarisk has increased in the Paria River Canyon as well as along the Colorado River. The lower terrace of the Colorado’s floodplain sustains tamarisk and seepwillow, with mountain rushes and phragmites along the shoreline. Four-wing saltbush, shadscale, and seepweed dominate the terrace.

Bill Lemke
28 December 1889
Nims’ view downstream of the confluence of the Paria and Colorado rivers shows the edge of the Paria River delta and a small lagoon below the sandbar. It also shows the rise of Lee’s Backbone, which is capped with Shinarump Conglomerate as shown in the foreground. Stanton’s railroad would have crossed the Backbone on its top before dropping down into Marble Canyon. The delta has recently aggraded during a Paria River flood and is devoid of riparian vegetation.
Franklin A. Nims, 57-RS-260, courtesy of The National Archives

29 January 1991
The delta has been scoured as the result of river reworking and changes to the mouth of the Paria River, which shifted from the upper side of the debris fan to its lower side around 1912. The remaining debris fan on the right side is reduced in size and the small lagoon above it has filled in with rock and sediment. The left shoreline remain the same, with the addition of tamarisk at river level. Also, the rock in the center of the channel persists from 1889. Shadscale individuals are on the ledge left of center.
Robert H. Webb

21 April 2011
On the ledge in front of the camera station, a Mormon tea and two shadscale individuals persist from 1889, although one shadscale has died. The tamarisk individuals at the river edge remain but are larger, and riparian vegetation has increased on both sides of the river. Rock has broken away from the pointed ledge in the center of the view below a large crack apparent in 1991.
Bill Lemke
28 December 1889
This view shows the upstream side of Lee’s Backbone and the bottomland on river left at the high-water ferry landing. A dirt road leads off the backbone and to that ferry site. The bottom of the view is cut off by the camera’s stage, and a crewmember is sitting below the camera; his hat is protruding slightly into the view. A narrowleaf yucca and three Mormon tea individuals appear in the foreground.
Franklin A. Nims, 57-RS-259, courtesy of The National Archives

30 December 1991
This is a rare instance where the landscape has changed more than the vegetation. The road leading to the ferry has disappeared, recovered following abandonment of the ferry in 1928, but the trail passing horizontally through the midground remains. Also, rocks have moved downslope in the slide at right center. A narrowleaf yucca persists from 1889 just left of center. A new prickly pear appears at right center and a new rubber rabbittbrush is on the edge of the view at left center. The Mormon tea individuals in the view have been grazed by livestock. Karen Reichhardt is models the hat in the extreme foreground.
Robert H. Webb

21 April 2011
After 122 years, Mormon tea persists throughout the foreground. The prickly pear remains near the right center edge and the rubber rabbittbrush persists near the left center edge. Diane Boyer models Mike Scott’s hat at bottom center.
Bill Lemke
Mile 1.2, Lees Backbone, Upstream View from River Left (Stake 2562)

28 December 1889
This upstream view from Lee’s Backbone shows the upstream part of the Paria River debris fan and the Paria Riffle. The debris fan has had a recent flood, which constricts the Colorado River, and it has no riparian vegetation. Higher river banks sustain shrubby riparian vegetation, likely arrowweed. On the ledge beyond the camera station, Mormon teas dot the cliff top.
Franklin A. Nims, 57-RS-269, courtesy of The National Archives

11 February 1992
In this view of Lee’s Ferry, the road, boat ramp, and parking lot that were constructed upstream from the debris fan in the 1960s are visible. The Mormon teas on the far ledge persist and there is a new plant on the near ledge. The large rock in the center of the river has not moved, while the two smaller rocks upstream have disappeared. The river eroded away the constriction apparent in 1889, probably during spring runoff in 1890. Riparian vegetation – mostly non-native tamarisk – established on the debris fan.
Ted Melis

21 April 2011
Riparian vegetation has increased along the river, in part because of flood control operations of Glen Canyon Dam but also because this view was taken later in the spring and plants are leafed out. The riparian area below the parking lot has been actively planted with cottonwoods and willows in a restoration effort. The Mormon tea individuals persist on the cliff tops after 122 years.
Bill LemkeMile 1.2, Lees Backbone, Downstream View from River Left (Stake 2563)
28 December 1889
Stanton needed to document his railroad route as the Colorado River, which briefly emerged from its canyon at Lee’s Ferry, plunged into the depths of Marble and Grand Canyons. Two of the crew members struck poses for this photograph taken opposite from Lee’s Ferry, overlooking the Kaibab limestone of Marble Canyon as it winds into the distance. The long sweep of beach visible at the right center is part of a large sandbar on the downstream side of the Paria River debris fan. While it is difficult to discern in this image, the man at right is sitting on a precarious rock that projects into open air.

Franklin A. Nims, 57-RS-270, courtesy of The National Archives

11 February 1992
The beaches have been eroded away, and Navajo Bridge, constructed in 1929, is barely visible in the distance. Jim Hasbargen is seated on the rock where one of Stanton’s crew members sat a century before, just not as far out as the man sat in 1889. Hasbargen did not throw that rock.

Ted Melis

21 April 2011
Few changes can be discerned in the twenty years between photographs. There is now a second bridge over Marble Canyon, but it is blocked from view by the original. Howling winds blew up the canyon on the day this image was taken, making it impossible to position the camera exactly, but the image is only slightly off. Three dust devils are visible in the center of the image, and the mixing of the muddy waters of the Paria River with the clear flow of the Colorado is affected by the wind. Photographer Bill Lemke set up the shot before crawling out to the perch on the rock, entrusting the acrophobic note-taker, Diane Boyer, to snap the shutter. Lemke was too busy holding on to hold a rock.

Bill Lemke
Mile 2.9, Cathedral Wash, Upstream View from River Right (Stake 2300)

28 December 1889
This upstream view shows the expedition’s wooden boats moored against the right bank in the center of the image. Mormon tea is the dominant plant in the left foreground, and a solitary plant appears in the foreground. A high river deposit sustains dense desert vegetation but is exposed as a flat surface in the left midground. Driftwood is present along the riverbank at lower right.

Franklin A. Nims, 57-RS-271, courtesy of The National Archives

29 January 1991
The high deposits have eroded back in the left midground, and there appears to be less desert vegetation present on the channel banks. Several Mormon tea in persist, particularly the individual the immediately foreground. Riparian vegetation has increased along the formerly barren low channel banks, notably small tamarisk.

Ted Melis

15 September 2010
This match is from a slightly different position but shows the same features in A. and B. Erosion of the high deposit appears to have slowed. The Mormon tea in the immediate foreground persists, but a large tamarisk tree that may have been present in 1991 now dominates the left midground. Tamarisk, brickellbush, and arrowweed dominate the midground channel margins just upstream from the debris fan.

Steve Tharnstrom
28 May 1889
When the Brown-Stanton Expedition pulled in at Cathedral Wash for one of their first photographs after leaving Lee’s Ferry, Nims set up on some eroded blocks of Kaibab limestone just upstream from the canyon and riffle. Sand filled the spaces within the rocks on the debris fan. The riffle is blurred by the long exposure. Mormon tea is present in the right midground.
Franklin A. Nims, 57-RS-272, courtesy of The National Archives

29 January 1991
The sand patches within the rocks on the debris fan have deflated or have been removed, in part because of floods from Cathedral Wash to the right. The persistent Mormon tea are perched on hummocks, and snakeweed is a new arrival in the desert vegetation. Tamarisk and brickellbush now grow among the rocks at left midground. Very few of the rocks on the debris fan have moved.
Ted Melis

15 September 2010
Riparian vegetation has increased on the debris fan, including increased size of existing tamarisk trees as well as infilling and stabilization of the remaining sand with other native and non-native species. A low-stage sandbar along the river is exposed because of low water (8,000 ft³/s) and following summer runoff in the Paria River.
Steve Tharnstrom
24 December 1889
The day before Christmas and a planned feast at Lee’s Ferry, a short distance downstream, three members of Stanton’s crew are surveying on a bench a few miles above Lee’s Ferry, opposite a long gravel bar. The vegetation in the foreground includes Mormon tea and four-wing saltbush; the taller plants behind the men are shrub live oak and hackberry.

Franklin A. Nims, 57-RS-245, courtesy of The National Archives

11 June 1975
This match includes the central portion of the original wide-angle view, and the other photographs have not been cropped down to this field of view. The shrub live oak and hackberry, leaied out in this summer view, persist. Mormon tea and four-wing saltbush, some persistent, are present, and pricklypear has become established. The gravel bar has been eroded by the clear-water releases from Glen Canyon Dam, and riparian vegetation (mostly non-native tamarisk) has become established along the channel, all results of the operation of Glen Canyon Dam 10 miles upstream.

Raymond M. Turner

30 October 1992
The amount of pricklypear, which includes beavertail and grizzlybear, appears to have increased, while some of the foreground shrubs have died. Bob Webb, Jan Bowers, and Mia Hansen pose in the same locations that Stanton’s crew stood a century before. The gravel bar on river left is once again visible owing to low-water releases from Glen Canyon Dam.

Tom Wise
28 December 1889
This upstream view overlooks a small sand deposit at the mouth of an unnamed side canyon on river left. The small trees in the right midground appear to be hackberry, and prince’s plume marks the old high-water line on river left.
Franklin A. Nims, 57-RS-273, courtesy of The National Archives

29 January 1991
Of the changes in the photograph, the most obvious is the addition of the original Navajo Bridge, built in the late 1920s. In addition, the sand bank has been replaced by gravel deposited by a recent flood from the small tributary. There has been a rockfall on the cliff (right center), and tamarisk now partially obscures the right side of the view.
Robert H. Webb

15 September 2010
The original Navajo Bridge is now a pedestrian bridge. A second bridge, built just downstream of the first in the mid-1990s, carries automobile traffic and is the prominent structure in the view. A thick growth of brickellbush mostly blocks the foreground and right midground. We noted 20 species present where banks were barren in 1889.
Bill Lemke
28 December 1889
This upstream view shows a long, low-elevation sandbar along the curve on river right, while the boats are tied up on a smaller one on river left. The shrubs in the right foreground are probably Mormon tea and shadscale.
Franklin A. Nims, 57-RS-275, courtesy of The National Archives

17 January 1990
A rockfall in the intervening century has changed both the foreground and the camera station, which is now by necessity on top of it. Another rockfall has occurred in the midground on river right. The foreground plants now include four-wing saltbush and beavertail pricklypear. Tamarisk now lines the river corridor. Although flow is higher, the low sandbar exposed in 1889 has been completely eroded.
Robert H. Webb

15 September 2010
There has been relatively little change in the twenty years since the previous photograph, although vegetation continues to increase in the area of the rockfall. The tamarisk have increased in density but have been partially defoliated by tamarisk leaf beetles.
Bill Lemke
28 December 1889
Badger Creek Rapid is the first major rapid encountered in Grand Canyon. The time of Nims’ view was not recorded in his diary or Stanton’s but was about 12:30 PM from the position of shadows on the left side of the river. The view captures the entire rapid; Jackass Canyon, sand bar, and debris fan on the middle right; and Badger Canyon fan and sand bar in the middle. Note the little triangular rock in contrast with the large sandstone slab in the left foreground.
Franklin A. Nims, 57- RS-277, courtesy of The National Archive

30 January 1991
The camping beaches on both sides were significantly eroded owing to operations of Glen Canyon Dam. Several monumented rocks show that the sand bar downstream of Jackass Canyon (left) has lost five feet of sand from 1890 to 1990. Note the substantial amount of erosion of the sand bar on the Badger side (lower center). Tamarisk is present on both banks and on the debris fans, and the largest clumps at lower center germinated before 1952. From this distance, the rapid does not appear to have changed significantly, but close examination of the mouth of Badger Canyon (left) shows new rocks from a debris flow that occurred early in the 20th century. Only streamflow floods have occurred in Jackass Canyon in the last century. Robert Webb reoccupied the position of one of Stanton’s boatmen, and the little triangular rock is still present.
Dave Edwards

15 September 2010
A debris flow from Jackass Canyon significantly altered the left side of the rapid in 1994, although much of the impact of this event was removed by the 1996 controlled flood. What is left of the aggraded debris fan is exposed in this view on river left. Several large tamarisk now grow on the Jackass Canyon sandbar on river left, and tamarisk and other riparian species have increased on the Badger Creek debris fan. John Mortimer is standing in the foreground, and the little triangular rock is still present despite a few new rocks that have fallen into the view.
Bill Lemke
29 December 1889
Small sandbars are scattered along the river corridor in this downstream view. The dominant plants are native perennial grasses and shadscale. At the lower right grows a shadscale in front of a grass, probably mesa dropseed.
Franklin A. Nims, 57-RS-279, courtesy of The National Archives

20 January 1991
More sandbars are exposed on river left in this view, although some that were present in 1889 – especially the large one on river left in the distant bend – are smaller. The biomass of desert plants in 1991 is similar to that in 1889. Tamarisk were present in 1991 but are not obvious on either bank. The shadscale at lower right persists, although much of the plant has died. The grass behind it is bush muhly. Only one of the rocks in the foreground has moved.
Dave Edwards

15 September 2010
The camera station is too far into the view, but most of the features of both the 1889 and 1991 views can still be seen. Sandbars generally are similar in location and size compared with 1991, although the prominent group in the left midground may have increased in size. Shadscale in the foreground and midground appear to have grown, but this is in part due to the camera position, which shows less of the formerly blocking rocks in the foreground.
Bill Lemke
What is now known as 10-Mile Rock appears next to the left shore in the midground of this upstream view. Although the image has some distortion and damage, some sand bars are visible along the river corridor, and the rocky channel banks are largely barren. The dominant desert plants in the foreground are Mormon tea, mesa dropseed, and beavertail pricklypear.

Franklin A. Nims, 57-RS-280, courtesy of The National Archives

Low-elevation sandbars are still present but have decreased in volume compared with 1991 bars. Tamarisk and other riparian species have increased, occupying the banks that were barren in 1889. Mormon tea persists, while grasses and beavertail pricklypear have increased. A new shadscale grows downslope of the nose of the prominent rock in the right foreground.

Ted Melis

Low-elevation sandbars are still present but have decreased in volume compared with 1991 bars. Tamarisk and other riparian species have increased, occupying the banks that were barren in 1889. Mormon tea persists, while grasses and beavertail pricklypear have increased. A new shadscale grows downslope of the nose of the prominent rock in the right foreground.

Steve Tharnstrom
**Mile 10.3, 10-Mile Rock, Downstream View from River Left (Stake 2302b)**

**30 December 1889**
Nims took this photograph mid-day with the sun in the upper left of his view, and he used his arm to shade the lens against the sun. An outcrop of Hermit Shale is present in the midground left. Soap Creek is the right side tributary in the distance as the river makes a left bend. The river banks are largely barren with large patches of exposed sand, including a sandbar exposed along the river in the midground. The dominant plant in the foreground is Mormon tea with scattered grasses and shadscale.

Franklin A. Nims, 57-RS-281, courtesy of The National Archives

**30 January 1991**
Some of the Mormon teas persist. Other plants identified in 1991 include beavertail pricklypear, mesa dropseed, and shadscale. A portion of the cliff face visible in the upper right of the image has flaked off, and the sandbars appear to be smaller than they were a century before. Tamarisk lines the river corridor where the banks formerly were barren, but the midground sandbar remains.

Ted Melis

**15 September 2010**
The camera station is too far into the view, but this does not change the view of various features present in 1889 and 1991. Tamarisk now occupies nearly all the exposed sand on the channel banks, but that midground sandbar is still present but may be smaller. Mormon tea still persists in the view. Stake

Steve Tharnstrom
9 July 1889
When the Brown-Stanton Expedition portaged Soap Creek Rapid, it encountered this broad expanse of sand below the rapid and camped. Nims took this upstream view using paper-stripping film that was not completely processed, which is why the view is murky. The next morning, Frank Brown, present of the railroad company, drowned in an eddy fence just downstream from this point. Lines of driftwood show earlier high-water stages of Colorado River floods.
Franklin A. Nims, 57-RS-284, courtesy of The National Archives

31 January 1991
There is no longer much driftwood visible on the sandbars in the view, and those sandbars have deflated and become vegetated with tamarisk and native species. A Mormon tea is prominent in the foreground, and tamarisk are scattered along the riverbank.
Robert H. Webb

15 September 2010
The Mormon tea clump has expanded and persists. Some of the tamarisks in the view show leaf beetle damage. The higher-elevation sand bars appear to be more densely vegetated and perhaps smaller, while low-elevation sand covers some rocks visible in 1991.
Robert H. Webb
31 December 1889
This downstream view at Salt Water Wash is from just downstream of the point where Frank Brown drowned. The shrubs visible are probably Mormon tea, and a thin deposit of sand at the lower right is perched on outcrops of Supai Group sandstone.
Franklin A. Nims, 57-RS-288, courtesy of The National Archives'

19 January 1990
A number of Mormon tea individuals persist over the intervening century. The sand is now completely gone, and a few shrubs, notably snakeweed, have become established in the cracks of the rocks below.
Ralph Hopkins

16 September 2010
The match is somewhat off but this does not affect interpretation of change in the view. Mormon tea continues to persist, while narrowleaf yucca and snakeweed are now prominent in the view.
Steve Tharnstrom
10 July 1889
This downstream view from upstream of the debris fan at 13-Mile Canyon shows desert vegetation in the foreground, a high-angle debris fan in the midground, and 13-Mile Rapid in the center. The dominant plants in the foreground are Mormon tea, shadscale, and perennial grasses, likely mesa dropseed.
Franklin A. Nims, 57-RS-287, courtesy of The National Archives

31 January 1991
A debris flow in the intervening 102 years has deposited several new boulders in the midground, but the wave pattern indicates the rapid has not significantly changed. Several of the Mormon tea and shadscale persist, including one plant in the center foreground. One individual of mesa dropseed appears to have persisted for 102 years in the right foreground; it may be persistant, or simply growing in the same location as a previous plant that has since died. Small beavertail pricklypear appear in the left foreground.
Jane Bernard

16 September 2010
The rapid and most of the debris fan remains unchanged after 121 years. Some Mormon tea present in both 1889 and 1991 persist in the foreground, and the mesa dropseed also appears to have persisted. Beavertail pricklypear persists since 1991, as do other plants captured in the 1991 image.
Steve Tharnstrom
11 July 1889
When Nims took this photograph from the shade of an alcove, a large sandbar, devoid of vegetation, dominated the view of the lower part of House Rock Rapid. The expedition’s boats are visible near the center of the image. At this discharge, about 5,000 ft³/s, the rapid was wide with few visible waves near its bottom.
Franklin A. Nims, 57-RS-293, courtesy of The National Archives

1 January 1992
Sometime in the 103 years between photographs, a large rockfall occurred, changing the foreground and burying the camera station, making an exact match impossible. The rapid has changed considerably, although the magnitude of the change is not obvious from this match. The hole at lower left in House Rock Rapid is apparent as a white streak in the river at right. The large sandbar is almost entirely removed, and a variety of vegetation, including longleaf brickellbush, desert broom, prince’s plume, grasses, and non-native tamarisk, has become established among the rocks.
Jim Hasbargen

16 September 2010
In the eighteen years since the first match, many of the individual shrubs have become much larger, and many new longleaf brickellbush have become established in the foreground. Tamarisk is much more prominent on the debris fan in the midground, in part because more are present and in part because the trees are leafed out in this late-summer view.
Bill Lemke
6 January 1890
In this upstream view, from a position just upstream from Boulder Narrows, several large pockets of sand are visible among the foreground boulders and on the opposite bank. A few clumps of grasses and a few shrubs are scattered in the foreground, which is at a stage that was annually flooded prior to completion of Glen Canyon Dam.

Robert B. Stanton, 57-RS-295, courtesy of The National Archives

2 February 1991
Much of the sand has deflated in the 101 years between photographs. Several new shrubs have become established, including desert broom, snakeweed, goldenbush, wirelettuce, white sagebrush, and tamarisk.

Ted Melis

16 September 2010
Several of the tamarisk are now much larger than they were 19 years before. Although the shrub in the foreground at left center has died, many have persisted and several are new. In particular, one seepwillow on the left side appears to be about the same size.

Bill Lemke
The Stanton expedition had trouble passing through the Roaring Twenties, a reach of closely spaced rapids between mile 20 and 27. With the drowning deaths of the previous summer on their minds, the crew lined and portaged most of the rapids in this reach. While a lining was underway around the rapid at mile 23.3, Robert Brewster Stanton made this upstream view at 11:30 AM. Apache plume, a facultative riparian species, forms the old high-water zone on the right side.

Robert B. Stanton, 57-RS-301, courtesy of The National Archives

Apache plume has decreased in more original and matched Nims-Stanton views than it has remained the same or increased. It has decreased in this view for two reasons: a debris flow from the unnamed canyon at right has destroyed many plants in the right foreground, and operation of Glen Canyon has reduced the amount of water available for those plants in the center. In addition to persistent individuals of Apache plume, three individuals of Mormon tea and three of Anderson thornbush around the rock at right center have persisted over the last century. The sand bar at left center has increased in size; sand bars in this reach typically have decreased in size over the last century because of erosion during high, clear-water releases from Glen Canyon Dam.

Ted Melis

A small debris flow has deposited several new boulders in the foreground since 1990, probably during a spate of debris flows in this reach in 1993-1994. Many of the plants present in 1990 in the foreground were destroyed by the debris flows, although some, including a cluster of longleaf brickellbush at center, remain. Several new shrubs have become established and the tamarisks on the opposite bank have become much denser. The once prominent line of Apache plume has decayed into scattered individual plants to limit intraspecific competition for water.

Steve Tharnstrom
While the Brown-Stanton expedition was lining the rapid at Mile 23.3, Stanton had ample time to make photographs of both the upstream and downstream views. The dominant plant in the left foreground and midground is Apache plume, which at that time defined the old high-water line. Four debris fans are visible in the image.

Robert B. Stanton, 57-RS-302/309, courtesy of The National Archives

2 January 1992
Some of the Apache plume are persistent, and new ones appear downslope as the old-high water line has deteriorated with flow regulation by Glen Canyon Dam. Longleaf brickellbush, a native shrub, and tamarisk, a non-native tree, is now present along the river (lower right corner of image). The debris fans appear to be unchanged, although there is new rockfall in the center of the image. The higher water level partially obscures the small beach at the center of the view, but it appears to have eroded by less than a meter and a new sand deposit lies above it.

Robert H. Webb

16 September 2010
Some of the Apache plume that were present in 1890 still persist, and many of the plants present in 1992 are still readily identifiable. Tamarisk has increased in both number and stature, and is now growing on the small beaches. Sand bars are more prominent in the view, in part because the water level is slightly lower, and the once prominent rockfall is less apparent because vegetation has colonized its surface.

Steve Tharnstrom
13 July 1889
The Brown-Stanton expedition, demoralized by the drowning of President Frank Brown upstream at Salt Water Wash, paused here midday to avoid the heat of summer. Harry McDonald, a boatman, carved his initials in a small juniper tree behind this camera station. When Nims took this image at 23.5-Mile Rapid, the debris fan in the foreground was devoid of vegetation, but considerable amounts of driftwood collected here within the sand and rocks on the downstream side of a large debris fan. Apache plume are growing along the high-water line at left center.
Franklin A. Nims, 57-RS-304, courtesy of The National Archives

2 February 1991
With the passage of 102 years, the debris fan has become vegetated with scattered Mormon tea, seepwillow, Apache plume, and perennial grasses. Only small amounts of driftwood remain in the foreground, but the eddy at center continues to collect driftwood, a resource depleted in the regulated Colorado River. A rockfall on river left has contributed numerous boulders, which appear white in this view, and moved others. Tamarisk is visible in the center of the image.
Ted Melis

16 September 2010
Vegetation in the foreground continues to increase, with the addition of many new plants, including a Mormon tea at front center; others present in 1991 have died. Many of these plants are short-lived species, including snakeweed. The driftwood has been rearranged, likely by river runners who frequently camp on the sandbar at midground. The beach is much larger than they were 19 years previously, but the stands of tamarisk growing upon them have greatly increased, probably decreasing the area of the camp but possibly trapping sand higher on the banks. This appears to be the case at right center, where the amount of sand upslope from tamarisk trees appears to have increased.
Bill Lemke
14 July 1889
Franklin Nims took this image "from [a] marble pier," a large outcrops of Redwall Limestone at the mouth of 24.5 Mile Canyon. This view up 24.5 Mile Canyon shows coarse boulder deposits characteristic of Colorado River tributaries, which episodically produce large debris flows. A relatively white deposit of boulders at the center of the image appears to be the result of a debris flow that did not reach the Colorado River. Most of the shrubs in the view are Mormon tea. Franklin A. Nims, 57-RS-306, courtesy of The National Archives

20 January 1990
Changes in the foreground of this view made matching Nims' view difficult, and the camera station is slightly off. The debris-flow deposit new in 1890 has been eroded away, and the canyon bed has scoured down 2-3 meters, probably during a streamflow flood in this relatively large canyon. While many of the individual boulders are still present, others are gone and others have been added. Some of the Mormon tea persist, and beavertail pricklypear is now growing in the right foreground. Ralph Hopkins

16 September 2010
This view matches the 1990 photograph. The boulders in the wash appear to be mostly unchanged in the two decades between matches, while the shrubs—mostly Mormon tea—have increased in size and number. The number of beavertail pricklypear in the foreground has increased, particularly in the left foreground. John Mortimer
14 July 1889
Nims stood atop a boulder of Coconino sandstone when he took this image down 24.5-Mile Canyon to the Colorado River, which is just visible in the distance. Desert vegetation in the view includes Mormon tea, hedgehog cactus, perennial grasses, and Anderson thornbush.
Franklin A. Nims, 57-RS-307, courtesy of The National Archives

2 February 1991
While the rocks on the slope in the left third foreground of the image are largely the same, a streamflow flood has altered the canyon bottom, removing, rearranging, and depositing numerous rocks and boulders. Despite this, many of the Mormon tea and Anderson thornbush on the left side of the view persist. The hedgehog cactus visible in 1889 is gone, although others are present in the view. A large beavertail pricklypear is now growing at left foreground.
Liz Hymans

16 September 2010
The canyon rocks and boulders have remained unchanged in the intervening 19 years between photographs, although one new boulder appears in the right foreground. Many of the shrubs and cacti are considerably larger now, and some new individuals have become established. The beavertail pricklypear in the left foreground is much larger, and numerous Mormon tea persist in the view. A large Anderson thornbush in the left foreground has persisted for 121 years.
John Mortimer
14 July 1889
Stanton, who after all was planning a railroad, identified a large outcrop of Redwall Limestone, which he called the Marble Pier, as a place to secure a two-part railroad bridge across the mouth of 24.5 Mile Canyon. Nims stood atop this outcrop to secure this image showing the pool downstream from 24.5 Mile Rapid, a riffle, and 25-Mile Rapid in the distance. A large amount of eolian sand is present across the foreground. The shrubs on the slope are primarily Mormon tea, the river corridor is mostly devoid of vegetation, and a sandbar is prominent on the upstream side of the debris fan at 25-Mile Rapid. Franklin A. Nims, 57-RS-308, courtesy of The National Archives

23 February 1995
After 106 years, the eolian sand has deflated to a moderate extent, and perennial vegetation has become established on its once mostly barren surface. Many of the same Mormon tea are still present, and a number of narrowleaf yucca are also visible. A few tamarisk are scattered along the shoreline. The sandbar upstream from 25-Mile Rapid has decreased in size.
Steve Tharnstrom

16 September 2010
The tamarisk have increased greatly in both number and size in the intervening 15 years, creating a near-continuous line along the left side of the river. The amount of sand appears to be similar. Some of the yucca have died, but many of the Mormon tea still persist. The sandbar upstream from 25-Mile Rapid has increased, resembling its 1889 size.
Robert H. Webb
14 July 1889
Nims secured this image, the third taken from Stanton’s Marble Pier, to show the Brown-Stanton expedition’s camp 37, in addition to the canyon and proposed railroad route, which would have proceeded on the right side of this view. 24-Mile Rapid, at that time a small riffle, appears in the center of the view as a prominent V. Large piles of driftwood are scattered near the shore. The plants that dot the slopes include Mormon tea, Anderson thornbush, and Apache plume.
Franklin A. Nims, 57-RS-305, courtesy of The National Archives

2 February 1991
Nims secured this image, the third taken from Stanton’s Marble Pier, to show the Brown-Stanton expedition’s camp 37, in addition to the canyon and proposed railroad route, which would have proceeded on the right side of this view. 24-Mile Rapid, at that time a small riffle, appears in the center of the view as a prominent V. Large piles of driftwood are scattered near the shore. The plants that dot the slopes include Mormon tea, Anderson thornbush, and Apache plume.
Liz Hymans

16 September 2010
24-Mile Rapid has widened owing to river reworking during controlled dam releases in 1996, 2004, and 2008, although it remains a more significant navigation hazard than it was in 1889. The most noticeable change in this view during the two-decade interval between matches is the increase in size and number of tamarisk. The increase in tamarisk is one reason why the sandbar on the upstream side of 24.5-Mile Rapid has declined as a usable campsite; erosion by operations of Glen Canyon Dam has also removed some of the sand present in 1889.
John Mortimer
13 January 1890
While Stanton’s crew was taking a much-needed break after portaging and lining Tiger Wash Rapid, Stanton climbed up to a terrace and captured this view of the debris fan emanating from a canyon (right side) that creates the rapid. Several pockets of sand are visible within the boulders on the fan. Stalks, both standing and fallen, of Utah agave are visible at right, with Mormon tea and Apache plume being the other dominant species.
Robert B. Stanton, 57-RS-316, courtesy of The National Archives

2 February 1991
At some point in the century between photographs, a small debris flow deposited more boulders on the fan, overtopping one of the small sand beaches. Some of the Mormon tea and Apache plume plants persist, and Utah agave is still present.
Liz Hymans

2 March 2005
A debris flow in the summer of 2004 substantially altered the appearance of the debris fan. A sandbar has been deposited, probably during the November 2004 flood, and this site is a popular campsite. Many of the same foreground plants are still visible, although the Apache plume appears to be thinning, probably in response to decreased water supply resulting from flow regulation. Two hedgehog cacti are now visible in the right midground.
Bruce Quayle

16 September 2010
A debris flow in the summer of 2004 substantially altered the appearance of the debris fan. A sandbar has been deposited, probably during the November 2004 flood, and this site is a popular campsite. Many of the same foreground plants are still visible, although the Apache plume appears to be thinning, probably in response to decreased water supply resulting from flow regulation. Two hedgehog cacti are now visible in the right midground.
John Mortimer
13 January 1890
On their first clear day in a week, the Stanton expedition finally got through the Roaring 20’s. The portaging and lining required every half mile had taken its toll; all the boats needed repair. The intended camp for the night of 13 January 1890 was South Canyon, where the crew would fix the leaky boats and retrieve the goods they had stashed six months earlier in an alcove. But rapids still impeded travel, and Tiger Wash Rapid required yet another portage of goods and lining of boats. At noon, when the rest of the crew was enjoying the sunshine, Stanton climbed onto a shady terrace on river left and made this downstream view, dominated by a juniper tree that was obviously dead some time before Stanton arrived.

Robert B. Stanton, 57-RS-317, courtesy of The National Archives

2 February 1991
Was the dead tree the intended subject of Stanton’s photograph? Whether intentional or not, the dead snag still dominates the downstream view at Tiger Wash Rapid. Small twigs collected from the tree and radiocarbon dated indicate the tree died about 550 years ago. The new juniper on the terrace is one of the few present along the river corridor. None of the Utah agaves have persisted the century, but many news ones occur throughout the foreground. Five individuals of Mormon tea and one of Anderson thornbush persist the century, but Apache plume has decreased on the left and increased on the right sides of the view. The small rapid behind the tree is informally called “MNA Rapid” for the Museum of Northern Arizona trip that witnessed the rockfall that created the rapid in 1974.

Liz Hymans

16 September 2010
The dead juniper is still standing, although some of its topmost branches are now shorter. Apache plume in the view is approximately the same, although the presence of considerable non-native brome grass somewhat obscures the perennial vegetation. The Utah agave in the foreground has died, and others have flowered and died, but new ones are apparent in the view. The juniper new to the view in 1991 has grown considerably. Tamarisk growing along the opposite bank has greatly increased.

John Mortimer
Mile 26.7, MNA/Tiger Wash, Downstream View from River Left (Stake 1562)

6 July 1889
When Nims captured this view in 1889, the foreground contained boulders scattered across sand, prompting him (or Stanton) to identify the image as “marble pavement.” There are a few Apache plume growing at left, but the foreground is largely devoid of vegetation.
Franklin A. Nims, 57-RS-318, courtesy of The National Archives

2 February 1991
A debris flow in the 102 years between photographs has greatly changed the near foreground, which made replication of this view very difficult. Some of the boulders visible in 1889, including the large dark one at center, have moved, and many new rocks and boulders are present. In the midground, the remnants of the rockfall from river right that created MNA Rapid in 1974 are apparent next to the river. Apache plume, some of it persisting, is growing on the rocky slope in the left midground; a longleaf brickellbush is visible at left. Driftwood is scattered in the center of the image.
Liz Hymans

16 September 2010
Once again, the foreground has changed dramatically, although this is in part because the camera station has been moved into the 1991 view; note the boulder in the left foreground. A large amount of sand is now deposited on the beach, vegetated with dense growths of tamarisk and seepwillow. A large driftwood log, probably deposited during one of the three large dam releases in the intervening 19 years, appears in the foreground. There is still longleaf brickellbush growing in the view, although the change in camera station has shifted the previous individual of longleaf brickellbush out of the view to the left.
Steve Tharnstrom
13 January 1890
Using his “Detective Camera,” Stanton photographed ten members of his crew lounging in the sun among the sand, boulders, and driftwood at Tiger Wash Rapid, probably resting after another arduous portage, this time around Tiger Wash Rapid. A small debris fan on the opposite shore (river right) is clearly visible.
Robert B. Stanton, 57-RS-34D, courtesy of The National Archives

13 February 1992
In the 1970s, substantial debris flows on both sides of the river completely altered the debris fans at the head of Tiger Wash Rapid. The sandbars here were covered in gravel and boulders, and no driftwood remains within this view. From the left, Liz Hymans, Kenton Grua, Tom Wise, Larry Skrobot, and Jan Kempster pose in the approximate locations of some of Stanton’s crew.
Jim Hasbargen

16 September 2010
A group of river runners was camped on the debris fan when we matched this image, their kitchen gear and boats largely obscuring the foreground. Another debris flow has occurred, this time in 2004, and the camera station is much higher than in either 1890 or 1992. Tamarisk is visible on the debris fan on the opposite side of the river. Perennial grasses, longleaf brickellbush, and seepwillow surround the campsite, a sandbar that was not present in 1992.
Steve Tharnstrom
16 July 1889
Taken from the top of the Redwall Limestone, approximately 75 feet above the Colorado River, this view shows the small riffle created by a debris fan on river right at mile 30. The Fence fault crosses the river approximately at the location of this debris fan. A large sand deposit is visible on the debris fan at center. The foreground vegetation includes Mormon tea and perennial grasses.
Franklin A. Nims, 57-RS-322, courtesy of The National Archives

2 January 1992
Most of the same foreground rocks visible in 1889 are still present, but a debris flow has altered the debris fan at center. Several of the Mormon tea persist, and apparently so have some of the perennial grasses. Cottontop cactus and beavertail pricklypear are now present, as well as individuals of narrowleaf yucca. Numerous tamarisk, brown in this winter view, are present along the river corridor.
Robert H. Webb

17 September 2010
The tamarisk, leafed out in this late summer view and hence more obvious in this view, have increased in both size and quantity, particularly on the debris fan across the river and on the near shoreline at center. The cacti, both pricklypear and cottomtop, have changed, with some individuals dead, some persistent, and some new individuals present in the foreground.
Steve Tharnstrom
16 July 1889
Nims stood atop the Redwall Limestone at the mouth of a canyon near mile 30 on the left when he took this view upstream from the Fence fault. Several sandbars are visible along the river corridor. Vegetation in the foreground includes Mormon tea, Apache plume, narrowleaf yucca, and desert bedstraw. No Utah agave are apparent.
Franklin A. Nims, 57-RS-321, courtesy of The National Archives

23 February 1993
Some of the same Mormon tea, Apache plume, and desert bedstraw have persisted the intervening 104 years. Several new plants are now growing at this location, including cottontop cactus, beavertail pricklypear, narrowleaf yucca, and hedgehog cactus.
Tom Wise

17 September 2010
Many of the same plants present in 1993 are still present, some of them noticeably larger, such as the beavertail pricklypear, narrowleaf yucca, and Utah agave. Some perennial grasses have died. Tamarisk, leafed out in this late summer view, is readily visible growing on the sandbars on the opposite side of the river.
Steve Tharnstrom
17 July 1889
On the day that Stanton chose to end his first attempt at navigating the river through Grand Canyon, Nims captured this image of two crew members on the broad, unvegetated beach at South Canyon, looking downstream toward Vasey’s Paradise (not visible, right side). The expedition, preparing to leave the river after the deaths of three of its members, cached most of its gear in a nearby alcove, but not in Stanton’s Cave, the opening of which is just visible in the cliffs on the right midground. Driftwood lines the shoreline here, deposited by a large eddy downstream from the debris fan of South Canyon.
Franklin A. Nims, 57-RS-327, courtesy of The National Archives

3 February 1991
Considerable change has occurred in this view over the preceding 102 years. There is considerably less sand on the beach now, making replication of the image difficult. Two of the same boulders in the left foreground are still visible; the other rocks were either deposited since 1889 or were uncovered as the sand was eroded. Several tamarisk trees grow out of the rocky deposit, and seepwillow has established along the back of the sandbar. Driftwood still accumulates on this beach, which is heavily used by river runners. Jim Hasbargen and Bob Webb pose in positions occupied by Stanton boatmen in 1889.
Ted Melis

17 September 2010
The tamarisk trees have grown, blocking more of the view from the original camera station. Riparian vegetation in general has increased, particularly the native seepwillow and the non-native tamarisk. From this vantage point, the sandbar either has not had net change over 19 years or it has increased in size.
John Mortimer
17 July 1889
The rocks at the mouth of South Canyon are visible in front of the Brown-Stanton boats tied up along the beach. On this, the final day of the Brown-Stanton expedition, the men cached supplies in a nearby alcove, giving Nims ample time to capture several views of the canyon. The water level was approximately 20,000 to 30,000 ft³/s at the time of this view.
Franklin A. Nims, 57-RS-325, courtesy of The National Archives

2 January 1992
A debris flow in the years between photographs has drastically altered the foreground of the view, and this combined with a much lower water level creates a view with far more exposed ground than in the original view. Marsh-type vegetation, including willows in the left foreground and tamarisk in the left midground, is now present.
Steve Tharnstrom

17 September 2010
A thick growth of riparian vegetation obscures much of the previous view, making an exact match impossible to achieve. Seepwillow grows in scattered clumps on the active channel bars, while a mixture of tamarisk and seepwillow lines the channel.
Stephen Kenney
17 July 1889
Nims took this image looking up South Canyon, and what would be the expedition’s route out of the Grand Canyon, on the last day of the photographic survey in the summer of 1889. Water from South Canyon is flowing toward the photographer, who was probably standing on a rock.
Franklin A. Nims, 57-RS-326, courtesy of The National Archives

13 February 1992
A debris flow has substantially altered the view, depositing many new boulders and downcutting the channel at the mouth of South Canyon. Water generally does not flow down this canyon at its mouth except during floods. Numerous shrubs, mostly four-wing saltbush, grow on the debris fan, while longleaf brickellbush and non-native tamarisk occur along the channel.
Jim Hasbargen

17 September 2010
Overbank flow has aggraded around rocks in the foreground and midground, altering the appearance of the view after 18 years. Many of the four-wing saltbush have died, although there are a few persistent individuals; longleaf brickellbush and tamarisk still line the channel in the view.
John Mortimer
Mile 31.9, Vasey's Paradise, Downstream
View from River Right (Stake 2527)

17 July 1889
While waiting for the crew to cache supplies at the mouth of South Canyon prior to evacuating the first expedition, Nims hiked down towards Vasey’s Paradise to take this image. The waterfalls at Vasey’s Paradise are not visible but flow off the near-vertical slopes at right center. A small redbud tree is growing at right center, and several clumps of perennial grasses are visible in the right foreground. A boulder island, which is outwash from the South Canyon debris fan upstream, can be seen along the left center.
Franklin A. Nims, 57-RS-328, courtesy of The National Archives

3 January 1992
Many small new rocks are present in the foreground, probably from a small rockfall(s). The grasses are gone and have been replaced by biological soil crusts and mosses, and Utah agave grow along the cliff at right. A redbud grows in the same place as the one 103 years before, but it is likely a different tree. While no individual rocks can be identified on the boulder island, it has roughly the same shape.
Steve Tharnstrom

17 September 2010
The camera station is slightly forward of the 1992 camera station, but the proximity to the cliff at right exaggerates some differences that are not real changes on the right side. Many of the same Utah agave and perennial grasses have persisted the intervening 18 years. The area that had sustained biological soil crusts has been scraped clean, apparently by bighorn sheep bedding at this site or possibly campers accessing the river corridor from South Canyon. The boulder bar is now more heavily vegetated than it was 18 years before, probably with seepwillow and non-native tamarisk.
Steve Tharnstrom
16 January 1890
Standing on a Muav limestone promontory, Stanton took this view showing the head of 36-Mile Rapid. A debris fan on the lower right constricts the river, forming the rapid; a sandbar is clearly visible on the upslope side of the debris fan. Desert vegetation growing on the slopes includes Mormon tea, Utah agave, Anderson thornbush, and Engelmann hedgehog. Biological soil crusts are also present in the immediate foreground.
Robert B. Stanton, 57-RS-336, courtesy of The National Archives

3 February 1991
The boulders on the debris fan have been reworked or possibly have been covered by a small debris flow in the last century. Riparian vegetation has established on the debris fan and along the beaches. Some of the Mormon tea and Anderson thornbush have persisted the century. The number of Utah agave and Engelmann hedgehog have increased, and several new plants, including Apache plume, cottontop cactus, pricklypear, and turpentine bush, have become established. The amount of biological soil crust present has decreased slightly.
Liz Hymans

17 September 2010
Engelmann pricklypear has greatly increased on the midground slopes in the past two decades, while many of the Utah agave, hedgehog, and cottontop cacti persist. A new sandbar, anchored by tamarisk, has been deposited on the riverward margin of the debris fan. The central part of the sandbar is dominated by longleaf brickellbush, and tamarisk is also common on the debris fan.
John Mortimer
16 January 1890
While Stanton took this view, the expedition crew members enjoyed the bright sunshine on a long, wide, sandbar just below what is now called Buck Farm Canyon. The small trees on the slope are probably mesquite, and a mesquite is just visible in the shadows at lower left.
Robert B. Stanton, 57-RS-341, courtesy of The National Archives

10 September 1994
The camera station is at a canyon now called Bert’s Canyon in honor of Bert Loper, whose boat was found here in 1949 after the 79-year-old Loper died running 24.5-Mile Rapid. The sandbar is now much smaller, and is densely vegetated with a mixture of mesquite, tamarisk, arrowweed, and coyote willow. The distant debris fan, at the mouth of Buck Farm Canyon, is covered with small boulders from a recent debris flow. Plants on the foreground slope include mesquite, Mormon tea, grizzlybear pricklypear, and desert needlegrass, but we cannot know whether these plants persist because of the deep shadow in the original photograph. Biological soil crusts are prominent in the lower left of this view.
Richard Jackson

18 September 2010
The vegetation both on the foreground slope and along the river corridor is larger and thicker. Short-lived shrubs such as snakeweed have increased in density, and beavertail pricklypear persist the intervening 16 years and have grown larger. Trampling in the foreground, possibly by deer, has decreased the extent of the biological soil crusts, but some dense patches persist.
Steve Tharnstrom
Mile 44.6, Below Eminence Camp, Downstream View from River Right (Stake 2732)

17 January 1890
This murky view, taken from a talus slope, overlooks a riffle and debris fan below the Eminence Break. Part of the now heavily used Eminence Camp appears at left center. The debris fan contains several large expanses of sand, and no vegetation. Several mesquite grow in the center foreground, along with beavertail pricklypear, Mormon tea, and Anderson thornbush. Biological soil crusts occur on the bare ground at lower right.
Robert B. Stanton, 57-RS-347, courtesy of The National Archives

23 February 1993
The poor quality of the original made for a difficult match, but many changes can still be detected. Most of the mesquite have persisted the century, as have Anderson thornbush and some of the Mormon tea. Pricklypear is present, and the biological soil crusts are more apparent at lower right. The large sandbar on the debris fan on river left (left side) has been eroded, and tamarisk now grows on its downstream end as well in the far left foreground.
Tom Wise

18 September 2010
Many of the mesquite continue to persist, but they are dying back, probably in response to the lowered water levels in the Colorado River. Anderson thornbush and Mormon tea present at the time of Stanton’s photograph persist, and the pricklypear growing in the right foreground persists from 1993. The biological soil crusts appear to have diminished but are still present. Tamarisk has increased in density and number on both sides of the river, and the sandbar juts further out, possibly an artifact of lower river flows at this time.
Bill Lemke
17 January 1890
Sand bars line the river corridor in this image, and the vegetation on the slopes includes Anderson thornbush, Mormon tea, and berry and grizzlybear pricklypear. Mesquite grows densely in the right midground in what would become known as the old high-water line. Biological soil crusts are clearly present throughout the foreground.
Robert B. Stanton, 57-RS-353, courtesy of The National Archives

4 February 1991
The sandbars are fewer and smaller with establishment of riparian vegetation and erosion, while the mesquite thickets above remain dense. Other riparian vegetation, notably non-native tamarisk, now lines the river corridor. On the foreground slope, there has been a marked increase in the biomass of cacti, with some of the pricklypear persisting the century. Mormon tea, particularly the ones in the right and left foreground, and Anderson thornbush, notably the one at lower left center, persist the intervening 101 years, and the biological soil crusts remain prominent.
Ted Melis

18 September 2010
Many of the individual plants visible in 1991 persist, including the Mormon tea individuals in the right and left foreground and the Anderson thornbush at lower left center. The biological soil crusts remain prominent in this view, showing the persistence and stability of this landscape feature. Both desert and riparian vegetation have increased in density and in number, with the increase in riparian vegetation as particularly obvious. Only a small area of open sand remains behind a veritable wall of tamarisk next to the Colorado River at right (channel left).
John Mortimer
17 January 1890
This view, taken on a cloudy day, has an evenness of tone that could not be achieved in either of the matches. The foreground slope, containing boulders and rocks from an old debris flow, dominates this view, and the debris fan at left center has a dense cover of catclaw. Desert vegetation includes Mormon tea, Anderson thornbush, Engelmann’s pricklypear, and grizzlybear pricklypear, with a dense stand of mesquite present in the left center of the image. An eddy system ringed with open sand appears in the center midground.

Robert B. Stanton, 57-RS-352, courtesy of The National Archives

24 February 1993
The debris flow is unchanged in the intervening century, and the once open sandbars are mostly colonized with riparian vegetation. Most of the riparian vegetation is tamarisk, which lines the river corridor. Most of the Mormon tea and Anderson thornbush persist the intervening 103 years. Some of the mesquite appear to have died, while pricklypears are present in the same locations as before. Overall, the number of cacti has increased, with hedgehogs and cottontop cacti present in this view. Other shrubs apparently new to the view include brittlebush and four-wing saltbush.

Tom Wise

18 September 2010
The debris fan is unchanged, and many of the desert plants persist the ensuing the 17 years between matches. The riparian vegetation in the center of the image appears to have increased, virtually eliminating the open sandbars. Catclaw persists on the debris fan in the left midground.

John Mortimer
18 January 1890
Snow capped the cliffs when Stanton captured this image showing a bend in the river downstream from Nankoweap Creek, a view that is one of the most famous in Grand Canyon. Similar photographs have been taken by hundreds of river runners visiting the remnants of prehistoric granaries at Nankoweap, which are in the cliffs high above the camera station to the right. The river is lined by broad sand bars at this water level. The dominant plant on the slopes is mostly Mormon tea, while mesquite is visible near river level. A fresh gully scar is visible at the far left coming from the steep slopes on river left. These cliffs frequently produce rockfalls.
Robert B. Stanton, 57-RS-360, courtesy of The National Archives

5 February 1991
The river level is higher than it was 1890, and overall the amount of sand lining the river has declined or is now covered with riparian vegetation. Some of the sand bars appear to have shifted and aggraded. The gully scar is no longer as prominent as in 1890. Many of the same Mormon tea plants persist, while several new brittlebush have become established. There are more mesquite growing along the sand bars, although these are difficult to discern in a veritable sea of non-native tamarisk.
Robert H. Webb

18 September 2010
Riparian vegetation continues to increase along the river, reducing the amount of sand that is visible at this distance. There has been a slight increase in the amount of mesquite, but overall it appears to be similar to that present 19 years before. Mormon tea persist, notably individuals on the left and right sides of the view. There are several new brittlebush present, along with a number of individuals that persist since 1991.
Bill Lemke
18 January 1890
Uncharacteristically, Stanton changed lenses and took two similar views from the same location looking the same direction. This view was taken with what is known as a normal lens, as opposed to the previous view, taken with a wide-angle lens. The dominant plant appearing on the slopes is Mormon tea. Mesquite is apparent at river level, upslope from the prominent sand deposits that line the river.

Robert B. Stanton, 57-RS-361, courtesy of The National Archives

5 February 1991
The river level is higher than it was in the original photograph, but the sand bars appear to have shifted and eroded; mesquite has increased, but not as much as the non-native tamarisk. Many of the Mormon tea plants visible in 1890 persist.

Robert H. Webb

18 September 2010
Sandbars continue to decrease in exposed area owing to erosion and establishment of vegetation, both native mesquite and non-native tamarisk. The mesquite are leafed out in this late-summer view, giving them a denser appearance than in the winters of 1890 and 1991. New brittlebush are apparent in the foreground, and Mormon tea persist from 1890.

Bill Lemke
18 January 1890
This upstream view of the Colorado River from river left shows a mostly barren hillslope of colluvium derived from nearby cliffs of Muav Limestone (right side). A few Mormon tea appear in the foreground as well as one brittlebush, likely blurred in the wind because the exposure time was long; Stanton’s camera had no shutter. This image shows what would become known as 55-Mile Marsh, but at this time the site, on the left side of the view in the shadows, is barren sand with a few exposed boulders. One of the many backwaters once present in this wide, low-gradient reach appears at left center.

Robert B. Stanton, 57-RS-362, courtesy of The National Archives

5 February 1991
A century later, the vegetation in 55-Mile Marsh includes non-native tamarisk, along with the mesquite, catclaw, and phragmites; other lower stature riparian species are undoubtedly present. This marsh is recovering from the high-water years of the mid-1980s, which removed much of the once thriving riparian ecosystem here and deposited considerable coarse sand in its place. The two Mormon tea individuals that were present in the foreground of the 1890 view are still alive 101 years later, but the original brittlebush is dead and a new one is closer to the camera station. Some of the mesquite in the old high-water line are dead or dying.

Ted Melis

19 September 2010
This match is forward of the original camera station, in part because the slope here is unstable, but this does not affect interpretation of change of any of the plants in the 1889 or 1991 views. The density of the marsh vegetation has increased, especially phragmites that lines the shoreline, in part because discharges in the intervening 19 years have mostly been low. Both Mormon tea individuals persist, although the one at front center is smaller; the brittlebush new in 1991 has died but three new plants appear in the view. Unlike many reaches, the mesquite on the right bank appear to be alive despite flow regulation, which has negatively impacted the old high-water zone through most of Grand Canyon.

John Mortimer
20 January 1890
Stanton stood on an eolian sand dune when he took this image. Perennial grass and what appear to be short-lived shrubs are established in the dune in the foreground. Mesquite grows upon a dune at left and catclaw appear in the right foreground and on the slopes opposite the drainage. Numerous shrubs, notably Mormon tea, are on the colluvial slopes at center and right. Sand bars are visible on both sides of the river in the distance.
Robert B. Stanton, 57-RS-367, courtesy of The National Archives

5 February 1991
During the intervening century, the sand dunes have shifted, although many of the same mesquite and catclaw are still present. The grasses in the foreground are mostly desert needlegrass, along with Indian ricegrass and globemallow. The sand bars are mostly vegetated with native riparian species and non-native tamarisk.
Liz Hymans

19 September 2010
The shifting foreground sands make matching this image difficult, and the camera station is too far into the view and cuts off part of the right side of the 1890 image; the original and 1991 images were not cropped down to the same background view. The mesquite and catclaw appear to be similar, albeit leafed out, and the riparian vegetation appears to have increased. The increased perennial vegetation in the foreground is mostly Indian ricegrass and dicoria and indicates that the eolian deposit has stabilized. This probably results from the decreased supply of fluvial sediment deposited along the river corridor, which winds once entrained to form these dunes.
Bill Lemke
20 January 1890
Stanton photographed this view looking downstream onto the wide, unvegetated gravel bar that extends downstream from the mouth of the Little Colorado River, which enters the mainstem Colorado River opposite the camera station. Scattered Mormon tea, catclaw, and beavertail pricklypear are visible on the mostly barren slopes. Although the view is into the sun, and a light flash appears at upper right, a low snowline appears on the distant cliffs, including Chuar Butte above the river at left center.
Robert B. Stanton, 57-RS-375, courtesy of The National Archives

23 January 1990
A century later, many of the same plants are still visible, with some mortality and recruitment of the Mormon tea, catclaw, and pricklypear. The gravel bar has been altered over the intervening century and is much wider on the right-hand side, and scattered shrubs – probably non-native tamarisk – have become established on its surface.
Ralph Hopkins

19 September 2010
The muddy water of the Little Colorado River can be seen intermixing with the flow of the mainstem Colorado River, which generally runs clear in Marble Canyon due to the sediment-settling that occurs upstream in Lake Powell. Some of the shrubs in the near foreground have died in the course of the past two decades, but others that were present in 1890 still persist. The vegetation on the gravel bar has grown in size and density, and tamarisk trees can be distinguished from the lower-stature native species and younger tamarisk near the shore of the Colorado River.
Steve Tharnstrom
From a ridge with a sweeping view, Stanton captured this image of the confluence of the Little Colorado (left center) and mainstem Colorado (lower left) rivers. At this point, Marble Canyon technically ends and Grand Canyon begins, although the latter term is often used to encompass the entire 270 miles of the river from Lee’s Ferry to the Grand Wash Cliffs. Snow occurs low on the cliffs extending down from Cape Solitude. The expedition boats are parked along the large, barren, gravel bar deposited by the Little Colorado River at its mouth. Scattered shrubs, mostly Mormon tea and grizzlybear pricklypear, are present on the slope below the camera station.

Steve Tharnstrom

The gravel bars have changed little in their overall location, lower water levels have allowed riparian vegetation to become established on them. The riparian vegetation, mostly tamarisk and arrowweed, has increased in height and density. On the foreground slope, some of the brittlebush present 18 years ago have died, while beavertail pricklypear has become established in addition to the grizzlybear. Many of the individual Mormon tea, pricklypear, and catclaw persist, along with some of the brittlebush.

Steve Tharnstrom
22 January 1890
This view looks across the upper part of the Palisades Creek debris fan, across the head of Lava Canyon Rapid, and up Lava Canyon. Several sand and cobble bars are apparent, including the large sandbar that appears to go half-way across the river, and marsh vegetation, probably mostly common reed, grows in the right midground. Individual rocks can be discerned in the head of the rapid. Clumps of mesquite are scattered across the midground.

Robert B. Stanton, 57-RS-384, courtesy of The National Archives

6 February 1991
Lava Canyon Rapid has changed considerably, owing to one or more debris flows over the past century from both sides of the river. The sandbars have decreased considerably, especially in the right foreground but also in the heavily used Lava Canyon camp across the river, and riparian vegetation, including non-native tamarisk, grows on both sides of the channel. Trails created by river runners extend from the Lava Canyon Camp, and another trail, part of the Beamer Trail, weaves through the mesquites in the foreground, many of which persist.

Robert H. Webb

19 September 2010
The rapid has not changed in the intervening two decades, and many of the same mesquite thickets are still present on the debris fan in the foreground. A river party is camped at the Lava Canyon Camp, and their boats somewhat obstruct the view of the size of the sandbar. A large sandbar has become established in the eddy at right center, and the riparian areas are now denser and wider, with large amounts of seepweed present. A brittlebush has become established in the rocks at left foreground; other foreground vegetation includes fluffgrass and Mesa dropseed.

Steve Tharnstrom
22 January 1890
Stanton turned his camera upstream to take this view of Temple Butte, which is prominent in the center skyline. A backwater lined with sand bars and marsh vegetation ringing its margin appears in the left midground. Several clumps of mesquite grow along the high-water line, and Mormon tea is present at several places in the right foreground.
Robert B. Stanton, 57-RS-383, courtesy of The National Archives

6 February 1991
A century later, some of the sandbars have been removed, leading to a large eddy with a ring of mostly non-native tamarisk. The amount of riparian vegetation has increased but mostly is tamarisk and mesquite. Many of the Mormon tea individuals in the right foreground persist, brittlebush is common, and a few cottontop cacti have become established.
Robert H. Webb

19 September 2010
Some of the Mormon tea present in 1890 continue to persist, and many of the same plants growing two decades ago, including catclaw, brittlebush, and cottontop, are still present. Several new plants, including brittlebush, Mesa dropseed, and snakeweed, have become established. The riparian vegetation zone has broadened and become more dense, with considerable growth of tamarisk behind a stand of what appears to be native species, including coyote willow, seep willow, and other species. The water level is slightly lower than it was in 1991, revealing more of the sand deposits in the eddy.
Steve Tharnstrom
Mile 65.5, Palisades Creek, Downstream View from River Left (Stake 1434c)

22 January 1890
Stanton took this spectacular view looking downstream across the Palisades Canyon debris fan and into Furnace Flats, with the South Rim of Grand Canyon, mantled in snow, in the background. The lower section of Lava Canyon Rapid is at right center. Sandbars line both sides of the river channel, including the large deposit in the center of the view (river left) that has become a heavily used river camp. The channel of Palisades Creek crosses the debris fan in the lower midground, with clumps of mesquite growing on both sides of the arroyo.
Robert B. Stanton, 57-RS-385, courtesy of The National Archives

6 February 1991
Our match captures a similar snowline in the background and shadows on the hillsides and cliffs throughout the view. The sandbars have deflated, particularly the one used as a river camp, and debris flows have altered the rapid and adjacent cobble bars. There are few changes to the midground, with many individual boulders readily identifiable and the mesquite having persisted. Tamarisk grows along the river corridor, particularly behind the river camp.
Robert H. Webb

19 September 2010
This late afternoon view, in late summer, shows sunset on the cliffs of the South Rim. The sandbar in the center of the image has increased in size, partially because of lower water levels but also because of seasonal sand inputs from the Little Colorado River about 4 miles upstream. The amount of riparian vegetation growing on both sides of the river corridor has increased and is especially noticeable at the mouth of Palisades Creek (right midground). The midground vegetation, which is leafed out in the warm season, appears to have increased slightly in density in the past two decades.
Steve Tharnstrom
22 January 1890
Stanton stood atop a large limestone boulder when he took this image overlooking a Pleistocene terrace on the downstream side of Comanche Creek. The Palisades of the Desert appear on the right skyline, and various buttes characteristic of the Proterozoic Grand Canyon Supergroup are on the left side across the river. Mormon tea is the dominant plant on this surface, and what appears to be cottontop cactus is also present. Mesquite appears in the midground growing along the high-water line adjacent to the river channel.

Robert B. Stanton, 57-RS-389, courtesy of The National Archives

25 January 1990
A century later, many of the Mormon tea and mesquite persist. Brittlebush and snakeweed are now also common. Overall, there has been little apparent change in the view.

Ralph Hopkins

20 September 2010
Some of the same Mormon tea and mesquite present in 1890 continue to persist, and many of the foreground plants have increased in size since 1990. Perennial grasses (fluffgrass and dropseed) and Russian thistle are also growing in this area. The plants in the riparian zone along the river corridor have increased, and most of the growth appears to be in tamarisk along the river channel at the mouth of Comanche Creek.

John Mortimer
22 January 1890
From the same perch atop the limestone boulder where he captured an upstream view, Stanton obtained this downstream image showing Comanche and Escalante Buttes in the distance and the mouth of Tanner Canyon in the left background. Snowline is extremely low, as seen in the drainage across the river at right. Mormon tea and grasses are present on the Pleistocene terrace in the foreground and midground, and mesquite clumps are visible along the high-water line.

Robert B. Stanton, 57-RS-390, courtesy of The National Archives

8 February 1991
Many of the Mormon tea and perennial grasses have survived the century, as have the mesquite, which appear to be denser today. Four-wing saltbush is now common, and snakeweed, fluffgrass, and brittlebush are also present.

Jane Bernard

20 September 2010
Some of the mesquite, grasses, and Mormon tea present in 1890 continue to persist, as do snakeweed, four-wing saltbush, grasses, and brittlebush from 1991. The general impression is an increase in size and density of perennial vegetation on this surface, but this could in part be caused by the seasonality difference between this view and the two previous ones. The riparian vegetation along the river corridor has increased in number and density, and common reed is visible in the bend in the center of the photograph.

John Mortimer
23 January 1890
Late in the afternoon, Stanton and his crew noticed a structure on the top of a promontory hill above Cardenas Creek. Stanton took this upstream view of what is now called Cardenas Hilltop Ruin, although at one time it was inexplicably known as Stanton’s Fort. Except for scattered mesquite and what may be clumps of willows, little riparian vegetation is present along the Colorado River. Numerous backwaters occurred in this reach, including the prominent complex at right center. The foreground slopes sustain an assemblage of desert vegetation, including Mormon tea, Anderson thornbush, and big galleta grass, among others.

Robert B. Stanton, 57-RS-396, courtesy of The National Archives

26 February 1993
Marshes, prime riparian habitat in Grand Canyon and elsewhere, provide habitat for native fishes and wildlife, particularly birds. Young native fish use the backwaters as protection from predators, and birds frequently nest in the dense vegetation. The marsh at Cardenas Creek, for example, is nesting habitat for southwestern willow flycatchers, an endangered species. Most of the increased riparian vegetation in the view is tamarisk, although Goodding willow, coyote willow, arrowweed, and other native species also have increased. The mesquite persistent from 1889 has died back, which has commonly occurred in Furnace Flats because of flow regulation. The backwaters in the view are reduced owing to sediment deposition and tamarisk encroachment. In the desert vegetation of the foreground, five individuals of Mormon tea, seven of wolfberry, and three big galleta grass persist.

Tom Wise

13 March 2003
Black willow increased significantly in the decade 1993 through 2003, and it can be seen extending overtop the dense tamarisk stand in the marsh. This species now provides additional structure in the Cardenas Marsh, presumably with benefits to the valued bird populations found here. The increase in this species suggests that tamarisk may be gradually replaced by native species. Upstream from the marsh, coyote willow and seepwillow are mixed with tamarisk, reducing open sand at this campsite, and a debris flow from Cardenas Creek that occurred in 1993 created an opening of sand and boulders through this mixture. Another debris fan on river right, aggraded by another debris flow in 1993, is barren. The mesquite stand behind the marsh continues to die back, and the sand dune that they grow on is becoming more prominent. Brittlebush are now prominent in the desert vegetation on the foreground slopes, although Mormon tea and Anderson thornbush continue to persist.

Dominic Oldershaw
20 September 2010
The small debris fan on river right is now partially vegetated, but there is little colonization of the coarse deposit at the mouth of Cardenas Creek. A large open sandbar extends downstream from Cardenas Marsh, but this likely resulted from seasonal deposition of sand from the Little Colorado River and likely will not persist. The Goodding willow in the Cardenas Marsh have crown dieback, suggesting that recent low-flow years may be impacting native species here. The mesquite on the sand dunes behind the marsh appear to be dying or dead, again resulting from flow regulation eliminating shallow ground water. Many new brittlebush are on the hillslope, Anderson thornbush continue to persist, and one of the two Mormon tea that persisted for 113 years has died.
Bill Lemke
The Cardenas Hilltop Ruin was once called Stanton’s Fort. Built and abandoned approximately eight hundred years ago by the Ancestral Puebloans, the walls had mostly fallen by the time Stanton photographed it on January 23, 1890, at 4:15 P.M. Despite Stanton’s earlier criticism that Nims was photographing too much scenery and not enough railroad route, Stanton chose to photograph the scenery here even though his railroad was to be along the opposite side of the canyon. The day was cloudy, and the low snow line in the background depicts the severe winter that Stanton’s crew experienced in Grand Canyon.

Robert B. Stanton, 57-RS-399, courtesy of The National Archives

The view was replicated in bright sunlight by Tom Brownold on January 25, 1990, at 12:00 P.M. Amazingly, the walls of the ruin have changed more than the desert plants that surround it. Only one plant has died in the past century: the wolfberry next to the ruin in the 1890 view. Otis “Dock” Marston took a similar photograph of Cardenas Hilltop Ruin in 1957, and the wolfberry was alive in Marston’s view. Ten individuals of Mormon tea and two other individuals of wolfberry persist.

Tom Brownold

The ruin has changed slightly in the past 21 years, although at least one rock has been added to the left side. The Mormon tea and wolfberry present in 1990 are still alive, and there are three new brittlebush, one new Mormon tea, and a new sand dropseed in the view.

Steve Tharnstrom
23 January 1890
A short distance from the distinctive archaeological site known as Cardenas Hilltop Ruin, Stanton took this photograph looking down into a canyon extending towards the Colorado River. The prominent peak on the center skyline is Vishnu Temple. Mormon tea is present in the foreground, and trees, likely mesquite, are growing along the old high-water line next to the river.
Robert B. Stanton, 57-RS-397, courtesy of The National Archives

10 February 1991
The match, slightly off, shows more of the Dox Formation hills in the left midground than does the original image, but a distinctive white boulder still appears at lower right. Some of the Mormon tea, including the one growing in front of the boulder, persist. Brittlebush, Anderson thornbush, and cottomtop cactus are also present. Some of the mesquite along the river appear to be persistent, and tamarisk is now established on the sand bars downslope of the mesquite. The sandbar complex along the river is a heavily used river camp providing access to Unkar Creek, which is about a half mile downstream on river right. A new debris fan, devoid of vegetation and dark in tone, appears on the upstream side of these sandbars extending out from a small, unnamed canyon.
Dave Edwards

20 September 2010
Several of the Mormon tea that were alive in 1890 persist; likewise, many of the shrubs and cacti documented in the view taken two decades before persist. The sandbar appears larger than it was in 1991, but this likely is the combined result of lower water levels at the time of this photograph and sedimentation from summer floods several months before. Both the riparian and desert vegetation assemblages appear to have increased in density, and the debris fan now supports considerable vegetation cover. Brittlebush, in particular, appears to have increased in the foreground, and this species is not obvious in the 1890 view.
Bill Lemke
25 January 1890
Stanton and his crew watched the rising walls of Shinumo Quartzite with concern. The narrow canyon meant the rapids ahead would be more severe. While the crew lined what is now called Nevills Rapid, Stanton made this upstream view at 8:15 AM. The fresh-looking deposit in the midground, which does not have any overlying sand from the Colorado River, indicates a debris flow occurred the previous summer. The large boulder at right center is approximately 12 feet in diameter. Driftwood in the right foreground indicates that the river regularly inundated the entire debris fan.

Robert B. Stanton, 57-RS-407, courtesy of The National Archives

27 January 1990
75-Mile Canyon has produced numerous debris flows in the last century, not the least of which is the removal of driftwood high on the debris fan. Changes in the foreground boulders are evidence of one of these debris flows; scars in catclaw trees indicate this flow occurred in 1959. The extensive deposition at the main part of the debris fan occurred during a debris flow in August 1987; note the burial of the large boulder that was more distinct in 1890. Riparian and desert vegetation in the foreground includes longleaf brickellbush and sweetbush. Upstream of the debris fan, tamarisk, coyote willow, and arrowweed grow on a sandbar and the more stable part of the debris fan.

Ralph Hopkins

10 February 1991
In September 1990, another debris flow occurred in 75-Mile Canyon. Boulders up to 8 feet in diameter were deposited during this flood. Note that the large boulder at right center has another 1-to-2 feet of material deposited around it. The debris flow removed some of the vegetation on the debris fan but left longleaf brickellbush and sweetbush in the foreground.

Ted Melis
28 October 2001
The large boulder once prominent at right center, is no longer visible because of aggradation on the debris fan. More debris flows, in 1993 and around 1999, have again altered the view, burying some of the tamarisk established after 1991 to a depth of 6 feet. More vegetation, mostly longleaf brickellbush and tamarisk, has become established on the debris fan, and brittlebush is clearly apparent among persistent plants in the foreground.
Robert H. Webb

30 October 2003
A debris flow in 2003 deposited a new line of boulders across the midground, burying or removing some of the tamarisk trees. The tamarisk that survived, on the upstream side of the boulder deposit, are still in leaf. Some of the plants in the foreground are the same as those in the 2001 image, with the addition of Mormon tea, more brittlebush, and seepwillow.
Dominic Oldershaw

6 March 2005
Two years later, the view appears quite similar to that in 2003. The tamarisk are leafless so are less apparent, giving the false impression that the seepwillow, arrowweed, and longleaf brickellbush are gaining in density and biomass. Many of the same shrubs are visible in the foreground.
Steve Young

20 September 2010
No debris flows occurred in the five years between 2005 and 2010, allowing an explosion of riparian vegetation on the debris fan. The existing plants have grown considerably, and the tamarisk is leafed out, revealing its prominence on the upstream side of the debris fan as well as along the shore of the Colorado River through Nevills Rapid. The view of the river is mostly obscured by the debris fan and vegetation.
John Mortimer
4 February 1890
While Stanton climbed up on a bench to obtain a better view, his crew prepared a meal and warmed themselves on a fire on a small beach at the mouth of what is now called Boulder Canyon. The long exposure time smoothed out the waves on the small riffle that was present, and smoke from the fire creates some haze across the debris fan, partially obscuring the boats parked upstream.
Robert B. Stanton, 57-RS-434, courtesy of The National Archives

28 January 1990
An unknown crew member poses in the same position as one of Stanton’s crew 100 years later. A debris flow at some point in the past century has dramatically changed the appearance of the beach and the riffle, depositing a train of boulders partway across the river. The river stage is similar to that in 1890, emphasizing the change and increased constriction in the river. Only a few small shrubs are visible in the foreground, and none elsewhere in the view.
Ralph Hopkins

21 September 2010
Twenty years later, the riffle has not changed in appearance, and many rocks in the river can be identified. Riparian vegetation, which includes longleaf brickellbush and seepwillow, has greatly increased. One tamarisk tree at the mouth of Boulder Canyon is prominent and appears to be new to the view.
Stephen Kenney
4 February 1890
Pulled up against the sheer walls of Vishnu Schist that line the Inner Gorge, Stanton obtained this downstream view next to a riffle. A piece of driftwood with smaller twigs around it is lodged between boulders of Vishnu Schist (lower left), and the gnarled remains of a dead tree are visible on the schist cliff at top left.
Robert B. Stanton, 57-RS-433, courtesy of The National Archives

7 January 1992
More than a century later, both the driftwood and the dead tree, a catclaw, are in the same locations. A radiocarbon date on fine twigs on the dead catclaw indicates that it died several hundred years ago. A small new Utah agave grows in a crack below this dead tree. A new catclaw has become established at left center. Other shrubs visible include sweetbush, Mormon tea, and needlegrass.
Robert H. Webb

21 September 2010
Eighteen years after the first match, the driftwood and dead tree are still present. The catclaw has grown larger, as have many of the other shrubs visible in 1992, notably the Utah agave beneath the dead tree. New catclaw acacia are now present along with several other new shrubs, notably sweetbush and perennial grasses.
Robert H. Webb
4 February 1890
In most cases, Stanton took distinct upstream and downstream views; this is one of the rare times he took two similar views (see Stake 1454a), this one with a normal lens that shows less of the view than the wide angle of Stake 1454a. The cloudiness at the lower center is from campfire smoke, and crew members can be seen working in the expedition’s wooden boats.

Robert B. Stanton, 57-RS-432, courtesy of The National Archives

7 January 1992
The water level is higher than it was in 1890, and the new riffle, visible in 1990 (see Stake 1454a) is largely submerged. The rockfall at left center appears to be unchanged in the intervening century.

Robert H. Webb

21 September 2010
The water level is lower, revealing the riffle that was created by a debris flow between 1890 and 1990. Riparian vegetation, including longleaf brickellbush and seepwillow, has become established since 1992 in the mouth of Boulder Canyon, and one tamarisk has become established at the base of the cliffs on river right.

Stephen Kenney
7 February 1890
Stanton, faced with navigating Horn Creek Rapid at low water, purposefully allowed one of his boats to drift into the rapid without oarsmen, a move the origin for which he attributed to John Wesley Powell. The Marie was smashed to pieces against a rock near the bottom of the rapid that we affectionately refer to as the Mace Rock, which damaged one of our boats in 1989. The eleven men of the expedition crowded into the remaining two boats, and the stop for photographs on the sandbar downstream Salt Creek was no doubt welcome. Only sand, boulders, and barren cliffs are visible.
Robert B. Stanton, 57-RS-460, courtesy of The National Archives

29 January 1990
Tamarisk is now the most common riparian plant in Grand Canyon. Although it was first documented in 1938, its colonization accelerated after the closure of Glen Canyon Dam in 1963. Tamarisk is beneficial to sandbars; as is apparent at left, tamarisk traps sand that might otherwise be washed downstream during periodic high releases. It also provides shade against the relentless summer sun, except during winter when it is leafless, as it is in this view. Rocks are scattered on the otherwise open sand by river runners who use this campsite heavily.
Glenn Rink

21 September 2010
The tamarisk now form a wall on the river side of this sandbar and are perched on hummocks of sand. Several trails cut through this wall, allowing access to the reduced sand area upslope of the tamarisk. About three feet of sand has eroded away, exposing many large boulders which were not visible twenty years earlier.
Bill Lemke
Mile 92.5, Salt Creek, Downstream View from River Left (Stake 1457)

7 February 1890
Looking back across his tracks, Stanton captured this view of a wide sandbar and boulders at Salt Creek. The crew is perched among the boulders, presumably enjoying the sunshine on what reportedly was a chilly February day in Upper Granite Gorge. What appear to be Stanton’s camera dark cloth and a box are visible in the lower left corner.
Robert B. Stanton, 57-RS-461, courtesy of The National Archives

29 January 1990
A large amount of sand deflation dramatically changes the appearance of the view and also made for an inexact match. Many of the same boulders are still present, including the large light-colored one at left center and the pile extending into the river at right center. A line of small tamarisk trees has become established in the center of the view, trapping sand in a hummock at what is now a popular campsite, and catclaw are growing among the boulders in the center of the image.
Glenn Rink

20 September 2010
The camera is located too far into the view, but changes in the past two decades are still readily apparent. The tamarisks are now much larger, providing desirable shade and wind protection as evidenced by the location of the camp kitchen. A foot of sand has accumulated behind the tamarisk in the past twenty years, partially burying some of the rocks visible in 1990. The distinctive light-colored boulder is now mostly obscured by catclaw, goldenbush, and tamarisk.
Todd Esque
8 February 1890
This view looks up the canyon of Hermit Creek from a bench above the river and the small river campsite. The plants growing on the slopes include catclaw and Mormon tea, and those in the arroyo are likely arrowweed. Mormon tea is prominent on the slope at center and right.
Robert B. Stanton, 57-RS-470, courtesy of The National Archives

27 February 1993
Many of the Mormon tea and catclaw are still alive a century later; those two plants, plus longleaf brickellbush and seepwillow, are the dominant plants in the view. There has been some deflation of sand in the slope in the midground. A small pricklypear grows on the rock in the left foreground.
Steve Tharnstrom

14 March 1999
The pricklypear is gone but not dead, as it will reappear in the next match. Despite this disappearing act, many of the plants present in 1993 are still visible six years later, notably the Mormon tea individuals on the slope and the catclaw trees along the wash. The latter are getting larger.
Dominic Oldershaw

22 September 2010
The pricklypear is gone but not dead, as it will reappear in the next match. Despite this disappearing act, many of the plants present in 1993 are still visible six years later, notably the Mormon tea individuals on the slope and the catclaw trees along the wash. The latter are getting larger.
Steve Tharnstrom
8 February 1890
This image was taken from the mouth of Hermit Creek, seen flowing in the foreground, at the head of Hermit Rapid. The rapid was far longer in 1890 than in the 20th century as a result of debris-flow deposition downstream at Boucher Rapid. In 1890, despite the fuzzy whitewater caused by the long exposure (Stanton’s camera did not have a shutter), the whitewater appears to extend into the distance, an observation verified by later surveying and photography. The wide debris fan is nearly devoid of vegetation. Mormon tea is visible growing on the slopes above the scour line of the river.
Robert B. Stanton, 57-RS-472, courtesy of The National Archives

31 January 1990
When this image was matched on a rainy winter day, we did not have a sufficiently wide angle lens to capture the entire view, which nonetheless shows most of the center portion of the image. The rapid, one of the largest in Grand Canyon, is clearly visible in our view owing to use of a fast shutter speed, and the pool below the rapid can be plainly seen at center. Some of the same large boulders are still visible on the debris fan, while many of the smaller rocks are gone or have moved. The stream course has slightly altered. There is now considerable vegetation on the fan and along the new high water line, including tamarisk, seepwillow, arrowweed, coyote willow, cattail, and various perennial grasses. The sand dune visible in the center left appears to have aggraded over the past century.
Tom Brownold

14 March 1999
This image matches the original Stanton field of view. A debris flow in 1998 has buried many of the large boulders, and small cobbles now dominate the foreground. The debris flow slightly increased the constriction in the center of the rapid, which for a brief period greatly increased the severity of waves near the bottom of the rapid. The tamarisk trees that were present nine years before have grown considerably in stature and now partially obscure the view of the rapid.
Dominic Oldershaw
31 October 2001
Tamarisk, seepwillow, and coyote willow now largely block the foreground view, and the creek bed has changed, precluding an exact match. The river is barely visible through the vegetation and only a small portion of the large boulder visible in the lower right of the 1999 match can be seen.
Tom Brownold

20 September 2010
Riparian vegetation, including arrowweed, seepwillow, and tamarisk, now completely obscures both the foreground and midground.
Mile 98.2, Crystal Rapid, Across Canyon View from River Right (Stake 1467)

9 February 1890
Stanton photographed this view of Crystal Rapid at about 11:45 AM on a day when the expedition paused to allow Harry McDonald to hike out Crystal Creek, leaving the expedition, and for the remaining crew to make repairs and climb the Tower of Ra without ropes. This view is one of four that documents changes in Crystal Rapid. Flow through the rapid is left to right, and the deepest part of the rapid appears at the bottom of the view. The rocks in the river are the eroded remains of a debris fan emanating from Slate Creek, the canyon entering at right center. One notable boat wreck occurred in these rocks, when the Tadje-Russell expedition of 1915 stuck and eventually sank a boat here. This eventually led to their abandonment of the Ross Wheeler at Bass Canyon about 9 miles downstream.

Robert B. Stanton, 57-RS-481, courtesy of The National Archives

1 February 1990
The repeat view was made in a light rainstorm at 12:20 PM. The background cliffs are partially obscured by low clouds. A debris flow in December 1966, one of the largest and certainly most notorious side canyon floods in Grand Canyon history, completely changed this rapid, which then changed again during the 1983 flood. The deepest part of the rapid in 1890 has been filled in with large boulders, many of which are larger than 12 feet in diameter. The constriction of the channel, which forced flow to the left, changed Crystal Rapid from a negligible rapid to the crux obstacle to navigation in the Inner Gorge. Note the lack of substantive changes in rocks that line the left, or Slate Creek, side of Crystal Rapid; this strongly suggests that the 1966 debris flow did not cross and dam the Colorado River. Although the riparian vegetation along the river is dormant in this winter view, the tamarisk and other species are sparse enough to clearly see the boulders on the debris fan.

Tom Brownold

22 September 2010
The tamarisk and arrowweed, leafed out in the warm season, growing along the debris fan now partially obscure the view of the rapid. The water level is lower than it was when the 1990 image was taken, with some of the boulders at the head of the rapid partially exposed and some of the rapid’s features looking quite different. Some of those differences were caused by dam releases in 1996, 2004, and 2008 and a small side canyon flood in 1998, which moved some rocks around on the right shoreline and along the right side of the rapid. In the 20 years between matches, the rapid has become considerably easier to run.

John Mortimer
**Mile 98.2, Crystal Rapid, Upstream View from River Right (Stake 1468)**

8 February 1890
When Stanton captured this view looking upstream from what is now known as the right scout point of Crystal Rapid, there was a considerable amount of sand among the boulders covered with dense biological soil crust. This high debris fan, probably an Early Holocene relict, was stable with a mature desert vegetation assemblage dominated by Mormon tea and perennial grasses.

Robert B. Stanton, 57-RS-477, courtesy of The National Archives

1 February 1990
A century later, the foreground shows the effects of trampling from river runners visiting the prominent scout point for Crystal Rapid. Most of the Mormon tea present in 1890 persist, although the biological soil crust and perennial grasses are victims of the foot traffic. Catclaw and goldenbush have either become established or are more clearly identifiable. The sandbars in the distance have deflated or at least are less obvious owing to the establishment of non-native tamarisk. The foreground surface has eroded – note the line on the foreground rocks where once they were buried – in response to the trampling.

Ralph Hopkins

22 September 2010
Many of the Mormon tea persist, particularly the one in the right foreground, although the perennial grasses that once grew here have not reestablished and the biological soil crusts continue to be trampled. The tamarisk, which is leafed out and hence more visible than in 1990, appears to have grown somewhat.

Bill Lemke
8 February 1890
Before 1966, Crystal Rapid was a benign, long riffle, especially in comparison with the rapids a short distance upstream and downstream. Had the Stanton expedition not lost a boat upstream in Horn Creek Rapid, Stanton likely would have decided to run this rapid. Instead, the crew portaged their belongings and lined their boats on the right side. Immediately upon arriving here, Stanton did what many modern river runners do: he walked up to the scout point on the debris-flow terrace overlooking the rapid and took this photograph. His view shows biological soil crusts on the fine-grained soil between boulders and clumps of perennial grasses, five individuals of Mormon tea, a barren debris fan, and a long and wide riffle with no island downstream.

Robert B. Stanton, 57-RS-248, courtesy of The National Archives

1 February 1990
Stanton’s view and its replicate illustrate a number of aspects of environmental change in the past century of Grand Canyon history. The change in the rapid, now one of the biggest on the Colorado River, was caused by a debris flow on December 6, 1966. An island, known to river runners as the Rock Garden, is prominent in the river downstream. Tamarisk, a non-native tree, chokes the once-barren mouth and debris fan of Crystal Creek, a perennial stream. Five individuals of Mormon tea persist on the edge of the debris-flow terrace, which likely is more than 10,000 years old. More subtle changes have occurred in the foreground, where biological soil crusts, which would have been very stable on this ancient debris-flow terrace, have been trampled by river runners intent on scouting Crystal Rapid. This impact has removed about three inches of soil from this site.

Ralph Hopkins

8 October 2002
Twelve years later, the amount of tamarisk, willow, and desert broom present on the debris fan have increased while the rapid and Rock Garden, as apparent from this view, is unchanged. All of the Mormon tea on the terrace edge persist but have changed in form. The trampling continues here, although the rapid now is more commonly scouted from river level.

Tom Brownold

22 September 2010
The riparian vegetation continues to increase, although native species seem to be increasing more than the non-native tamarisk, which are increasing in size and stature. The five Mormon tea individuals, which were present 120 years ago, remain on the terrace edge.

Bill Lemke
17 February 1890
The view looks downstream at Bass Rapid, named for local pioneer William Wallace Bass, who established a tourist camp in this region around the same time as Stanton’s visit. Mormon tea, grizzlybear pricklypear, and hedgehog cactus are among the plants visible in the right foreground. Biological soil crusts are present in the spaces among the outcrops and boulders in the view.
Robert B. Stanton, 57-RS-511, courtesy of The National Archives

14 February 1991
Some of the Mormon tea persist, while pricklypear and brittlebush has become much more common. Brittlebush is abundant on the slopes in the right midground, and the overall density of desert vegetation has increased in the past century. The biological soil crusts are partially obscured by non-native red brome. The sand beach at left has deflated by about two feet. While not visible except at strong magnification, the rocks above the beach at left center house another addition: the Ross Wheeler, a metal boat abandoned by the Russell-Tadje trip in 1915, when the trip members decided to abandon their problem-riddled filming expedition.
Jane Bernard

23 September 2010
Many of the brittlebush, Mormon tea, and pricklypear present in 1991 persist, with a small amount of mortality and recruitment. Brittlebush has increased throughout the view, notably in the foreground, and biological soil crusts are more prominent owing to a reduction in the red brome grass. Riparian vegetation is now well established along the sand bank or river left. The Ross Wheeler is still perched among the rocks.
Todd Esque
17 February 1890
With his back to Bass Rapid, Stanton obtained this view showing sweetbush, pricklypear, and Mormon tea growing in the spaces between outcrops and boulders of the dark-colored diabase the occurs in this reach. Several small sand beaches are visible adjacent to the river, and Stanton’s boats are parked in the distance on the right bank.
Robert B. Stanton, 57-RS-510, courtesy of The National Archives

14 February 1991
After 101 years, pricklypear, probably a hybrid of grizzlybear and beavertail pricklypear, is more abundant today. Brittlebush also is present, and other Stanton views in this vicinity showed that it was present in low density in 1890. While sweetbush still grows in the area, none of the individuals appear to have persisted the century. The beaches have deflated by several feet, and the one at center is now vegetated. In taking this image, Bernard had to shade the lens against the sun, with the dark slide used visible in the upper right corner.
Jane Bernard

23 September 2010
The match is slightly off, but individual plants are readily identifiable. Many of the sweetbush, Mormon tea, and pricklypear present two decades before persist. The vegetation growing on the sandbar, leafed out in the warm season, appears to have increased.
Todd Esque
17 February 1890
This view captures a broad expanse of sand at the upper end of Bass Camp, a heavily used campsite frequented by river runners. This part of the sandbar, which probably is wind-transported the short distance upslope from the Colorado River, has scattered catclaw and Mormon tea in the midground and Mormon tea with other shrubs, particularly a few brittlebush, in the midground and left background. A Mormon tea appears in the center foreground. The crew’s footprints are clearly visible in the sand.
Robert B. Stanton, 57-RS-516, courtesy of The National Archives

15 February 1991
A century later, the sand has deflated in some areas, particularly at the top of the dune, and aggraded in others, and more vegetation now present, stabilizing this eolian sand as it has in many other parts of Grand Canyon. Many of the catclaw and Mormon tea have persisted the intervening century. Other plants present include beavertail pricklypear, brittlebush, and burroweed.
Raymond M. Turner

23 September 2010
Many of the Mormon tea and catclaw that were present in 1890 are still alive; and several other woody plants visible in 1991 persist the intervening 19 years. The amount of sand is similar to that present in 1991. The apparent increase in density of perennial vegetation beyond the eolian sand patch appears to mostly be the result of increases in perennial grasses and brittlebush.
Bill Lemke
17 February 1890
John Wesley Powell and his geologist, Clarence Dutton, had warned Stanton that he would not find a level place to serve as a switching yard. With a touch of sarcasm, Stanton called the place where he would have built such a yard “Dutton’s Depot.” After the crew lined Bass Rapid and stopped for lunch just below, Stanton climbed up about 300 feet above the river to make one last view of his proposed switching yard. The extensive foreground shows ten individuals of Mormon tea and a few spiny asters. A pricklypear appears at lower right.

Robert B. Stanton, 57-RS-518, courtesy of The National Archives

20 February 1992
We first replicated this view in 1990, but returned two years later to replicate the view under conditions more similar to those in 1890. Unfortunately, the bright sunlight of 1992 caused considerably deeper shadows than those caused by cloudy conditions in 1890. Only three of the individuals of Mormon tea have died during the century; all were in the center of the 1890 view. In contrast, brittlebush, shown here with its silvery leaves and hemispheric shape, dominates the assemblage, with about ten brittlebush now appearing in the view. The pricklypear did not persist, and spiny aster no longer appears in the foreground.

Steve Tharnstrom

22 September 2010
Many of the same brittlebush that were present in 1992 are still alive; two have died. Most of the Mormon tea that had persisted the preceding century are still alive, but several more have died, notably in the lower right foreground and in the center of the view. This turnover in Mormon tea is unusually high compared to most views in Grand Canyon.

Bill Lemke
February 19, 1890, began hard and ended easily for the Stanton expedition. At the start of the day, the crew portaged their gear around Waltenburg Rapid (mile 112.2); then they lined and portaged their boats. Afterwards, they lined 112 1/2-Mile Rapid, finishing just in time for lunch. In the afternoon, the cloudy sky of morning turned to sunshine, and the rough whitewater turned into a mostly quiet reach between cliffs of schist and granite. At mile 114.2, the expedition stopped and Stanton climbed up the right bank to capture this upstream view at 3:08 PM.

Robert B. Stanton, 57-R5-539, courtesy of The National Archives

1 March 1993
Stanton’s view is not totally clear in the center foreground; few desert plants can be identified beyond a pygmy cedar at lower left, now dead. But at the lower left, the dark black soil surface is a cryptobiotic crust that is still in the same position and approximately the same size a century later. Careful examination of the edge nearest the camera indicates the crust has retreated a maximum of about 15 cm; the edge farthest from the camera is nearly unchanged. Cursory examination of its surface indicated the crust contains mosses and lichens, which is suggestive of an old, complex assemblage of organisms.

Steve Tharnstrom

23 September 2010
The new camera position is slightly to the right, but the various geologic and botanical features are still readily identifiable. Many of the foreground plants have grown considerably in the intervening 17 years between photographs, including Mormon tea, sweetbush, wirelettuce, and grizzlybear pricklypear. The cryptobiotic crust, on the other hand, has suffered from trampling, likely by bighorn sheep, although its outline is approximately the same after 17 years.

Bill Lemke
19 February 1890
This photograph is from a granite ledge about 200 yards downstream of what is now known as lower Garnet Camp. When Stanton was here, it was just a convenient place to land and take upstream and downstream photographs, including this view that mostly shows bedrock slopes at the unconformity between Tapeats Sandstone (whitish-colored rocks at left) and granite (right). Mormon tea, spiny aster, and grasses—including big galleta and three-awn—grow on the slopes in the right foreground. A small beach, much of it covered by rocks, is visible at the center.
Robert B. Stanton, 57-RS-540, courtesy of The National Archives

1 March 1993
Many of the Mormon tea and some of the perennial grasses persist. A sweetbush and a Mormon tea have become established in the lower right corner of the view. Trixis, brittlebush, desert bedstraw, and snakeweed are also present, and small amounts of biological soil crust are visible in the spaces between plants. The sandbar is now vegetated, probably with tamarisk.
Steve Tharnstrom

23 September 2010
Many of the Mormon tea, sweetbush and three-awn that were present two decades before have persisted. The Mormon tea in the lower right corner has gotten much larger, and now mostly obscures the sweetbush behind it. Vegetation on the small sandbar has become noticeably denser.
Bill Lemke
12 February 1890
On a morning in February 1890, after camping on a sand bar at mile 115, Stanton decided to "take it easy" while waiting for the sun to illuminate this view. As Stanton exposed the negative at 8:00 A.M., the crew loaded the last of the equipment and supplies onto the twenty-two-foot boats. His view shows mostly sand and boulders lining a river corridor largely barren of riparian vegetation except in the old high-water zone, which appears on the upper right and consists of mesquite and catclaw trees.
Robert B. Stanton, 57-RS-542, courtesy of The National Archives

22 September 1976
The water level was much higher when Raymond Turner first matched this image in 1976 using a narrower lens than the extreme wide angle lens that Stanton used 86 years before. His rowing snout, a 22-foot inflatable raft, is parked upstream from where Stanton’s boats were moored. Non-native tamarisk trees occur sporadically along both shorelines, and at least some of the high sandbar present in 1890 remains at this site.
Raymond M. Turner

21 August 1984
In 1984, Turner returned after the high-water years of 1983 and 1984 to again match this view, although again he used a lens with a narrower field of view than the original. The 18-foot rubber raft he came downstream in is parked downstream of the location where the Stanton boats were parked. The water level is high enough to obscure most of the beach, and high water has damaged or killed many of the tamarisk that were present in 1976.
Raymond M. Turner
22 February 1992
This is the first match that used a lens of sufficient field of view to capture the entirety of Stanton’s view 102 years previously. Because of considerable erosion, the sand bar could be used only with considerable difficulty by modern river runners. Eight members of our crew posed in the approximate positions as Stanton’s crew to illustrate the difference in the amount of sand between 1890 and 1992. The sand bars in this view have steadily decreased in size over the sixteen years of photographic replication, at least for the amount above a stage around 30,000 ft³/s. However, the higher sand bar at extreme right center has increased in size, probably as a result of deposition during the 1983 flood. Tamarisk have reestablished along the river corridor, although they are difficult to discern because they are leafless in this winter view. Crown dieback can be seen in the old high-water zone mesquites on the upper right, and new shrubs have established downslope.

Steve Tharnstrom

23 September 2010
There is now considerably more sand present than there was 18 years previously, although not as much as there was in 1890. Some of the large boulders that were visible on the sand bar are now buried, others are no longer present, and some are hidden by tamarisk trees and native species, including seepwillow. Russian thistle is abundant on the open sand in the midground.

Steve Tharnstrom
Mile 122.8, Forster Canyon, Up Canyon View from River Left (Stake 1487a)

20 February 1890
Low clouds obscured the distant cliffs when Stanton took this photograph looking up Forster Canyon across an eolian sand deposit. Mormon tea, grizzlybear pricklypear, grasses, narrowleaf yucca, and catclaw are scattered across the slope in the foreground.
Robert B. Stanton, 57-RS-558, courtesy of The National Archives

4 February 1990
A century later, the narrowleaf yucca have grown much larger, and some of the Mormon tea and catclaw also persist. Several clusters of pricklypear are now here, along with snakeweed, Indian ricegrass, and big galleta grass.
Tom Brownold

24 September 2010
Two decades on, many of the yucca, Mormon tea, and catclaw that were present in 1890 are still alive, while some of the Indian ricegrass and big galleta from 1990 persist as well. The catclaw are leafed out and hence easier to see, but appear to have grown in the twenty years since the previous match. Pricklypear, some of it persistent since 1990, has increased in size and in quantity.
Bill Lemke
20 February 1890
The weather was rainy but warm when Stanton secured this view at about 3:46 PM. The expedition spent a rare day of running rapids instead of lining and portaging them. Stanton summed up the pleasure of river running with his description of 122 Mile Rapid: “We run [122 Mile Rapid] in fine style. High waves but we cut through on the left and miss them all. What beautiful rapids all day today.” After running Forster Rapid, Stanton photographed this downstream view to capture an individual of narrowleaf yucca in the foreground.
Robert B. Stanton, 57-RS-555, courtesy of The National Archives

1 March 1993
The narrowleaf yucca, or rather its stems that arise from the persistent root crown, remains in the same place as the original plant stood a century before. This species reproduces vegetatively as well as through seeds. Several Mormon tea on this slope, with its sparse cover of eolian sand, have died, but several others persist. A catclaw in the center of the view to the right of the narrowleaf yucca is leafless but persistent over the past 103 years, looking very much the same size but with different branches.
Tom Wise

24 September 2010
While the stems of the narrowleaf yucca that were visible in 1993 appear to have died back, a new stem seems to be growing from the same root crown. There is less big galleta grass growing in the right midground than there was two decades before. The catclaw, leafed out in this late-summer view, is larger than in the two previous views. Tamarisk is now growing along the river, along with some coyote willow.
Bill Lemke
Mile 122.8, Forster Rapid, Upstream View from River Left (Stake 1759b)

20 February 1890
This view shows a broad expanse of eolian sand with scattered vegetation, including catclaw, Mormon tea, narrowleaf yucca, and perennial grasses, in the foreground and Forster Rapid in the left midground. The waves of Forster Rapid are smoothed out by the extended time exposure of the film. A small stand of arrowweed grows in the left midground. Large piles of driftwood line the river bank, and a large sandy beach is visible at the river bend.
Robert B. Stanton, 57-RS-554, courtesy of The National Archives

16 February 1991
Many of the catclaw and Mormon tea persist, and there has also been some mortality and recruitment. The narrowleaf yucca at the left center is still alive, although others present in 1890 have died. The sand has deflated where the arrowweed once grew. Dominant grasses are Indian ricegrass, big galleta grass, and Mesa dropseed, and rubber rabbitbrush and snakeweed are also present. The driftwood is no longer visible, and tamarisk lines the left shoreline. The sandbar at the bend has deflated and is covered with vegetation, probably mostly tamarisk.
Jane Bernard

24 September 2010
The camera station is slightly forward and to the left, but most of the plants and features of the original and first match views are identifiable. Some of the narrowleaf yucca have died, while Indian ricegrass has increased both in size and density. Mormon tea and catclaw continue to persist. The riparian vegetation, leafed out, is more readily apparent and appears to have increased in density, and individual tamarisk trees are apparent in the left midground and across the river in the apex of the bend.
Bill Lemke
22 February 1890
Stanton captured this image in the black amphibolite of Middle Granite Gorge, a short section of outcropping Proterozoic metamorphic rocks. 128 Mile Rapid appears in the distance. Numerous barrel cacti are scattered throughout the foreground, along with a few Mormon tea and other shrubs.
Robert B. Stanton, 57-RS-568, courtesy of The National Archives

16 February 1991
Of the barrel cacti that were present a century before, only one individual is in approximately the same position as a cactus a century before, but many new plants have become established. Some of the Mormon tea persist, notably one in the left midground. Brittlebush, not apparent in 1890, is common; one in the left foreground obscures a Mormon tea individual present a century before. Spiny brickellbush also is present in this view.
Robert H. Webb

24 September 2010
Many of the individual barrel cacti, Mormon tea, and brittlebush present in 1991 persist the intervening 19 years. Pricklypear, new to the view, reflects the increase in this group of plants in many photographs of Grand Canyon.
John Mortimer
Mile 127.9, Colorado River, Upstream View from River Left (Stake 1582b)

22 February 1890
This upstream view shows a rough surface on the top of the black amphibolite of Middle Granite Gorge with Tapeats Sandstone in the right midground. Barrel cacti are the most readily identifiable plants in this view, although perennial grasses appear to be present on the colluvial slopes under the Tapeats Sandstone. While Mormon tea is also present, the image is too blurry to permit identification of the other plants. Fluffgrass, surprisingly enough, is readily identifiable in the immediate foreground.
Robert B. Stanton, 57-RS-567, courtesy of The National Archives

16 February 1991
Barrel cacti grow in abundance on this surface, and Mormon tea individuals, subdued in the 1890 view, can be seen to persist. Fluffgrass continues to grow in the foreground and throughout the view, but this biennial species is unlikely to have persisted for 101 years. Other plants growing here now include brittlebush, three-awn grass, and spiny brickellbush.
Robert H. Webb

24 September 2010
In the ensuing two decades, there has been some mortality and recruitment of the barrel cacti, with many individuals persisting the intervening 19 years. Spiny brickellbush, three-awn, and brittlebush also persist. Fluffgrass continues to grow in the foreground, although in slightly different positions; this seems to suggest that this short-lived species prefers certain sites in the amphibolites.
John Mortimer
Mile 130.4, Bedrock Rapid, Upstream View from River Right (Stake 2581)

22 February 1890
This striking upstream view of Middle Granite Gorge was taken from a pegmatite terrace above the head of Bedrock Rapid. Barrel cacti, spiny brickellbush, Mormon tea, desert bedstraw, claretcup cactus, barrel cactus, and Utah agave grow on the steep rocky slope in the left foreground.
Robert B. Stanton, 57-RS-571, courtesy of The National Archives

23 February 1992
Several of the individual plants persist, including Mormon tea, spiny brickellbush, desert bedstraw, and claretcup. Many of the same species are still in the area, although the overall plant cover has increased slightly.
Robert H. Webb

24 September 2010
The desert vegetation has changed little in the ensuing two decades, with the majority of the plants visible in the previous match having persisted. The water level in this image is lower than it was in the previous photographs, but the amount of sand present in the small beach at lower center has clearly increased and is anchored by a new growth of non-native tamarisk.
Clavey Wendt
**Mile 130.5, Bedrock Canyon, Up Canyon View from River Right (Stake 2331)**

**22 February 1890**
Before running Bedrock Rapid, at that time a minor reach of whitewater, Stanton climbed to a ledge overlooking the river and took this photograph of Bedrock Canyon. His railroad would span this canyon on a bridge from the sandy, grassy slope on the right to the rocky slope on the left, with its sparse cover of Mormon tea. A few barrel and pricklypear cactus occur on these slopes.

Robert B. Stanton, 57-RS-572, courtesy of The National Archives

**17 February 1991**
A century later, many of the same Mormon tea appear on the slope, but many more barrel cacti are now present and cacti in general have increased. Grizzlybear pricklypear cacti remain in the same places, which reflects a persistence based on clonal reproduction instead an individual long-lived plant. On the other hand, one claretcup cactus does appear to have persisted at one point on the left slope.

Gary B. Bolton

**24 September 2010**
The barrel cacti and pricklypear continue to increase while the Mormon tea continue to persist. Several clumps of claretcup cactus also persist. Overall, this view reflects both the stable desert shrub framework that pervades most of the river corridor while species thought to have been limited by severe freezes continue to increase.

Clavey Wendt
**22 February 1890**

At the end of Middle Granite Gorge (mile 130), diabase, a distinctive intrusive rock that is greenish-black in Grand Canyon, forms a prominent ledge on both sides of the Colorado River. Before running Bedrock Rapid, Stanton climbed through a notch in the diabase at 9:00 AM to photograph his railroad route, which would have passed through the center of this downstream view. Earlier in the day, he referred to "the garden on top of the granite" and the "mountain with snow in distance." In other words, he was definitely admiring this mid-morning view as a distraction from documenting his railroad route. Six barrel cacti are scattered through the view; no brittlebush is visible.

Robert B. Stanton, 57-RS-574, courtesy of The National Archives

**17 February 1991**

When Hymans replicated Stanton’s view below Bedrock Rapid, the weather was cloudy for this view, taken at about 1:30 PM. Barrel cactus has increased; eighteen are visible in 1991. None of the cacti visible in the 1890 view have persisted. Brittlebush is now common here, and numerous catclaw and Mormon tea persist on the slopes at right.

Liz Hymans

**24 September 2010**

One of the barrel cacti visible in the near foreground in 1991 has died while the other one has grown much larger. Overall, the number of visible barrel cactus has increased in the past twenty years. Many of the woody shrubs, including Mormon tea, brittlebush, and catclaw, persist from 1991.

Steve Tharnstrom
24 February 1890
Although Stanton’s railroad route would be cut through the diabase cliffs on the right side of this view, most of what appears are sloping debris fans and colluvium leading towards the bottom of Tapeats Rapid. Mormon tea, white bursage, catclaw, and barrel cactus were the dominant plants when Stanton captured this view. Sandy beaches heavily used by pre-dam river runners are visible on the opposite shore.

Robert B. Stanton, 57-RS-584, courtesy of The National Archives

8 February 1990
A century later, many of the same Mormon tea, white bursage, catclaw, and barrel cacti are still present, along with many new plants. The beaches on river right have eroded away, to return ephemerally after periodic high dam releases; the upstream one by about two feet and the one farther downstream by three or four. On the day this photograph was taken, the water level is about three feet lower than it was in 1890.

Ralph Hopkins

25 September 2010
The camera station is slightly off, creating problems with the cliffs on the right side, but many of the same plants and rocks can be identified. Many of the desert plants persist, particularly Mormon tea. The sand bars on river right appear to have similar amounts of sand to the 1990 view, and there is more vegetation – mostly tamarisk – present on them. Tamarisk, leafed out in the warm season, is readily apparent along the left shoreline as well.

John Mortimer
24 February 1890
In addition to the view looking downstream, Stanton took a photograph looking up the Tapeats Creek drainage, which features a perennial stream, a large debris fan, and scant vegetation. The creek channel is also relatively free of vegetation, indicating recent scouring. Above the high water line on river left, visible in the foreground, are Mormon tea and catclaw.
Robert B. Stanton, 57-RS-583, courtesy of The National Archives

4 March 1993
While some of the same boulders are visible on the debris fan on river right, it has been aggraded by a debris flow that occurred in about 1962 and has subsequently been reworked. The mouth of the Tapeats Creek channel has shifted slightly, and the creek is now lined with dense riparian vegetation, including tamarisk, seep willow, and some coyote willow. In the foreground, several individuals of Mormon tea and catclaw persist, and tamarisk is common along the Colorado River.
Tom Wise
25 September 2010
There is a new deposit of small boulders in the creek mouth, the result of periodic flash floods in this large drainage, and the channel has again shifted. Riparian vegetation on the debris fan has continued to increase in density and stature. Some of the same Mormon tea and catclaw acacia present in 1890 persist, along with desert plants that were present in 1993.
John Mortimer

Mile 137.6, Above Doris Rapid, Upstream
View from River Right (Stake 1765a)

24 February 1890
Looking upstream from the head of what is now called Doris Rapid, Stanton took this image showing the glassy water above the rapid, with a large sandy beach on river left and a slightly smaller one on river right. Mormon tea and catclaw are the dominant plants in the foreground, along with clumps of perennial grasses. One Mormon tea individual is prominent on the left side of the view.
Robert B. Stanton, 57-RS-591, courtesy of The National Archives

18 February 1991
A century later, the beaches have altered in form but are similar in volume, and non-native tamarisk grows on both of them. Tamarisk is also present on the debris fans on river right (left side in view). Some of the Mormon tea and catclaw persist, particularly the Mormon tea in the left foreground, and there are now many barrel cacti, including a prominent individual in the center foreground, and brittlebush in the view.
Dave Edwards
25 September 2010
The beaches are largely obscured by riparian vegetation two decades after the first match. In addition to tamarisk, seepwillow, desert broom, arrowweed, and waterweed are present in lesser amounts. The prominent Mormon tea in the lower left corner of the image has died back but remains alive, while the catclaw at lower right has grown. While some of the same barrel cacti remain after 19 years, there has been some death and recruitment. Brittlebush appears to have increased on the foreground slope.

John Mortimer

24 February 1890
The Colorado River had suddenly risen 3 feet during the night although the heavy rains had ended several days before. Stanton and his crew began to reap the benefits of higher water, which covered rocks and allowed rapids to be run in relative safety. Stanton’s crew did just that by running 134-Mile and 135-Mile Rapids. After lunch, they arrived at 137 1/2-Mile Rapid, also called Doris Rapid after Doris Nevills, who inadvertently swam it in 1940. To Stanton, the rapid offered “high waves, a drop of 8 to 10 feet. Exciting river. Run it.” Before running the rapid, Stanton made this downstream view from the right side at about 1:00 PM.

Robert B. Stanton, 57-RS-592, courtesy of The National Archives

18 February 1991
From this angle, the rapid appears unchanged over the last century, but we know from other evidence that the rapid changed significantly shortly before 1940, causing Norm Nevills to misjudge the run through the rapid and dump his wife Doris in for her swim. Prominent catclaw trees at center and right center are more than a century old. Four other catclaw, three clumps of big galleta grass, and two individuals of Mormon tea also are still alive. Biological soil crusts, just apparent in the 1890 photograph, appear undisturbed in the immediate foreground.

Jane Bernard
25 September 2010
Two decades later, the view is remarkably similar. The catclaw trees, leafed out, are still apparent, as are some of the Mormon tea and big galleta grass. The barrel cactus in the left foreground has grown considerably, and one that in 1991 was obscured by shrubs is now prominent. The amount of snakeweed and brittlebush has increased slightly over the past twenty years. The biologic soil crust in the immediate foreground is both well developed and undisturbed.

John Mortimer

Mile 141.7, Below 141-Mile Rapid, Upstream View from River Right (Stake 2548)

24 February 1890
Half a mile below 141-Mile Rapid, Stanton captured this view from an unstable talus slope on a sunny afternoon. Mormon tea and three-awn grass are the dominant plants, with some catclaw present in the small drainages leading from the cliffs of Redwall Limestone and Muav Limestone that line the narrow canyon in this reach. Mesquite is also likely present in the old high-water line above the river, although it is not obvious in this view.

Robert B. Stanton, 57-RS-595, courtesy of The National Archives

25 February 1992
Many of the Mormon tea, catclaw, and three-awn have persisted the century, and it appears that plants now obviously mesquite persists as well. There are many new additional catclaw present, including one on the downslope end of a rectangular slab of rock in the left midground. Other plants include spiny brickellbush and brittlebush. A small debris flow has added a pile of boulders at the center of the midground. Tamarisk is growing along both shorelines but is mostly leafless in this wintertime view.

Steve Tharnstrom
25 September 2010
The catclaw and tamarisk, which are leafed out in the warm season, are more readily apparent than they were in the 1992 image, but individuals of these species appear to have increased in number and size. Many of the Mormon tea that were present in 1890 persist, and individuals of big galleta grass have persisted since the original match in 1992.
Robert H. Webb

Mile 143.4, Kanab Creek, Downstream View from River Right (Stake 1504a)

24 February 1890
The mouth of Kanab Creek attracted many photographers during the Powell era owing to the short-lived gold rush that occurred here. Stanton knew this and took this photograph of the debris fan at the mouth of Kanab Creek as its juncture with the Colorado River. The waves of the rapid are smoothed out by the long exposure time required by Stanton’s shutterless camera. Scattered catclaw and Mormon tea are visible on the slopes in the foreground and beyond the debris fan.
Robert B. Stanton, 57-RS-597, courtesy of The National Archives

9 February 1990
The debris fan has changed, both through reworking (removal or rearrangement) of boulders during floods or deposition of new sediments, and the rapid appears to be different. For one thing, the rapid now starts further upstream, and emergent rocks appear at the upstream right side, indicating new deposition. Only a few of the larger boulders near the head of the fan are still present, and there are only a few scattered shrubs growing upon the fan. Some of the catclaw and Mormon tea persist; the catclaw in the right
foreground have grown considerably, while the number on the slope beyond the debris fan has increased.
Raymond M. Turner

25 September 2010
The catclaw, which is leafed out, and Mormon tea in the foreground have increased in size in the past two decades. More striking is the dramatic increase in riparian vegetation, likely tamarisk, established on the debris fan. The boulders on the fan that are visible appear to be unchanged in the past twenty years.
Robert H. Webb

Mile 143.4, Kanab Creek, Upstream View from River Right (Stake 1504b)

24 February 1890
Looking upstream from the same camera station he used to photograph Kanab Creek Rapid, Stanton captured this view showing a vegetated rocky talus slope. Barrel cacti, Mormon tea, big galleta grass, and catclaw can be discerned in the shadowed foreground.
Robert B. Stanton, 57-R5-596, courtesy of The National Archives
25 February 1992
Many of the same catclaw and Mormon tea are visible, along with a few of the big galleta grass. Mormon tea and big galleta are still the dominant plants in the view, but barrel cactus is no longer present. Tamarisk now grows along the river channel on both sides of the river. A small rockfall has deposited a few new boulders and moved others in the foreground, but many of the same rocks are present.
Ted Melis

25 September 2010
A large number of the catclaw and Mormon tea that were present in 1890 still persist, but the big galleta grass that was prominent in 1992 appears to have died back. The amount of riparian vegetation—tamarisk as well as seepwillow and arrowweed—has increased greatly in the past two decades.
Robert H. Webb

Mile 167.1, Downstream from National Canyon, Upstream View from River Left (Stake 1584a)

26 February 1890
From a point about fifty feet above the river and just downstream of National Canyon, Stanton took this image showing a small sandbar and a variety of desert vegetation. Several clumps of beargrass grow along the slope, and Mormon tea, catclaw, and Utah agave can be identified. The day was overcast, eliminating the strong shadows normally present in this part of Grand Canyon.
Robert B. Stanton, 57-RS-610, courtesy of The National Archives
19 February 1991
At the time of this photograph, the water level was three or four feet lower than the 1890 view, making the sandbars appear larger, although they are probably similar in size. While the individual beargrass plants appear to have died, there are live rosettes in the same areas, and catclaw has persisted the century. Other desert plants include Anderson thornbush, Utah agave, and Mormon tea; in the riparian zone, coyote willow, dicoria, and non-natives Russian thistle and tamarisk are present.
Liz Hymans

27 September 2010
The desert vegetation appears to be similar to what it was 19 years before, while the riparian vegetation has increased substantially. Arrowweed and Bermuda grass are now present, along with tamarisk and coyote willow.
John Mortimer

Mile 167.1, Downstream from National Canyon, Downstream View from River Left (Stake 1584b)

26 February 1890
Stanton’s image downstream from National Canyon shows an interesting pattern of light on the river, owing in part to his long exposure time and the lighting conditions at the time of his visit. The river had risen in the days before this image was secured, perhaps peaking at the time of this photograph. A large catclaw dominates this view, largely obscuring a sandbar just downstream. Mesquite is growing at what is now called the old high-water line, and greythorn is also present.
Robert B. Stanton, 57-RS-611, courtesy of The National Archives

19 February 1991
Many of the same mesquite and catclaw are still present, including the plant in the immediate foreground, and the greythorn has also persisted the century. The sandbar has aggraded somewhat and is now partially vegetated. The water level is three or four feet lower than it was in 1890.

Liz Hymans

27 September 2010
The moon was setting over the distant cliffs when John Mortimer took this match at 9:16 AM. The match is slightly off, but not enough to affect the interpretation that many of the catclaw, mesquite, and greythorn that were present in 1890 continue to persist. The sandbar at center is now covered with a thick growth of riparian vegetation, mostly arrowweed and non-native tamarisk, which also lines much of the river channel.

John Mortimer

Mile 176.0, Red Slide, Upstream View from River Left (Stake 1767a)

26 February 1890
The reach just upstream from Lava Falls Rapid has a number of interesting geomorphic features, ranging from pockets of relictual basalt to the remnant colluvial deposits known as Red Slide (upper left). Along with the colluvium, this view shows talus slopes and cliffs and the mouth of Cove Canyon in the distance. A few scattered pockets of sand line the opposite (right) shore. The foreground is largely dominated by desert broom. Two of the expedition’s boats are visible behind a boulder at lower center.

Robert B. Stanton, 57-RS-614, courtesy of The National Archives
19 February 1991
A debris flow sometime in the past century has deposited a pile of boulders in the foreground and midground. The water level is much lower as shown by the exposure of the boulders across the river in the center. Desert broom remains common here, along with creosotebush, catclaw, brittlebush, Anderson thornbush, Mormon tea, and various other shrubs and cacti.
Dave Edwards

27 September 2010
The camera angle is slightly off, changing the perspective of the foreground; only the tip of the large white boulder in the foreground is visible in the 1991 view. The vegetation is leafed out in the warm season and appears to have grown in stature, with some of the catclaw, Anderson thornbush, creosotebush, and desert broom persisting since 1991. A few brittlebush now grow on the debris fan as well.
Steve Tharnstrom

Mile 176.0, Red Slide, Downstream View from River Left (Stake 1767b)

26 February 1890
This view downstream from Red Slide shows Toroweap Point in the distance. Desert vegetation, including catclaw and barrel cacti, is visible in the foreground of this downstream image. A sandbar can be seen in the center of the image as the river bends out of the view.
Robert B. Stanton, 57-RS-616, courtesy of The National Archives
19 February 1991
Some of the catclaw have persisted the century at this site. Barrel cacti are still present, although none of the same individuals have survived. Other plants include brickellbush, creosotebush, and Mormon tea. The sandbar is now partially vegetated with desert broom.
Jane Bernard

27 September 2010
Many of the catclaw, some persisting since Stanton’s visit, now have mistletoe growing in them. Creosotebush and Mormon tea also are persistent, while the desert broom growing along the river channel has increased in number and density.
Steve Tharnstrom

26 February 1890
Just downstream of Vulcan’s Anvil, Stanton took this view with a member of his crew posing in the left foreground. The dominant shrub on the foreground slope is creosotebush, and biological soil crusts are dense here, developed on substrate weathered from the dolomite of the Muav Limestone. Mormon tea, white bursage, barrel cacti, and catclaw are also present.
Robert B. Stanton, 57-RS-618, courtesy of The National Archives
10 March 1993
Most of the creosotebush and some of the white bursage have persisted the intervening 103 years, and the creosotebush appears to be larger in stature. While none of the individual barrel cactus persist, the number of cacti have greatly increased. Tamarisk grows along the river corridor, with mesquite upslope from it and catclaw scattered along the slope. Heavy rainfall in the winter of 1993 led to lush growth of annuals, particularly non-native brome grasses.
Gary B. Bolton

27 September 2010
Many of the creosotebush and white bursage that were present at the time of Stanton’s original photograph have persisted another two decades. Most of the barrel cactus that were present in 1993 are still alive, although there also has been some mortality and recruitment. The mesquite, catclaw, and tamarisk, which are leafed out, appear to have increased in density in the last two decades. Bob Webb stands in the same position as Stanton’s crew member.
Bill Lemke

Mile 179.3, Lava Falls, Up Prospect Canyon
View from River Left (Stake 1510a)

27 February 1890
In addition to views upstream and downstream from what is now the left scout point at Lava Falls Rapid, Stanton took this image looking up Prospect Canyon. The dominant shrub is creosotebush, and many barrel cacti are visible.
Robert B. Stanton, 57-RS-620, courtesy of The National Archives
11 February 1990
A cairn was found at the site of this triple set of photographs, one of the few physical signs of the Stanton expedition left in Grand Canyon. A century later, most of the creosotebush present in 1890 persist. One or two of the barrel cacti are in the same locations of individuals in 1890 but are likely not persistent; the number of barrel cacti present 100 years later is much larger than in the original view.
Raymond M. Turner

6 March 1995
In the early hours of March 6, storm runoff plunged over the rim into Prospect Canyon, mobilizing sediment into a debris flow that constricted Lava Falls Rapid. The following morning, recessional flow, visible in the upper center of the image, continued to plunge over the waterfall, which otherwise cannot be discerned from the Colorado River. The foreground vegetation, including a few ocotillo in the midground, is lush in response to abundant rainfall in the winter of 1994-1995. There has been little apparent change in the five years between photographs, although the barrel cacti have increased slightly in height. Pricklypear is more readily apparent in the view.
Robert H. Webb

29 March 2003
In the eight years between photographs, some of the larger barrel cacti have died, while many small ones have either become more visible or are new. Creosotebush continue to persist throughout the view.
Steve Young
11 March 2005
Two years later, there is little apparent change in this view. A large amount of non-native brome grass is present, growing in response to above-normal winter rainfall in the winter of 2004-2005.
Bruce Quayle

27 September 2010
There has been little apparent change in the numbers of creosotebush and barrel cacti. One of the ocotillos appears to have died, or died back. After 120 years, the creosotebush have changed little in number but have clearly increased in stature, while the number of barrel cacti have increased significantly.
Bill Lemke

Mile 179.3, Lava Falls Rapid, Downstream View from River Left (Stake 1510b)
27 February 1890
The night of February 26-27, 1890 was the coldest experienced during the Stanton expedition. Stanton and his crew had decided to portage goods and line boats on the left side of Lava Falls Rapid, but the weather was frigid on the morning of the 27th. To keep warm, John Hislop decided to set fire to the dry vegetation that surrounds the warm springs at the base of the rapid. Stanton waited until 11:00 AM for the smoke to clear to get a better view of the rapid. Note the chaotic appearance of the rapid at a discharge of about 10,000 ft³/s and the large rock (about fifteen feet across) at right center in the rapid (the “missing rock”).
Robert B. Stanton, 57-RS-621, courtesy of The National Archives

11 February 1990
The rapid has changed considerably in the century between the views because of debris flows from Prospect Canyon (left). A debris flow that occurred in 1939 deposited the prominent low terrace at left center; subsequent debris flows in 1954, 1955, and 1963 contributed to changing the upper left of the rapid from a relatively quiescent area to whitewater choked with boulders. As a result of the 1939 debris flow, flow through the rapid was forced to the right and the “missing rock” rolled downstream and was submerged. This rock is the cause for what is now called the “Big Wave,” a formidable obstacle to navigation on the right side of the rapid. The “Ledge Hole,” which appears at lower right, formed after the 1955 debris flow and gained its full width after the 1963 debris flow. Creosotebush in the foreground has persisted, and the lone barrel cacti present in 1890 is dead with only a couple of new ones in the left foreground.
Raymond M. Turner

6 March 1995
Steady rainfall on March 5, 1995 caused a debris flow in Prospect Canyon in the early morning hours of March 6, confining the river to a channel about 40% of its previous width. This image, taken mid-morning, shows the newly-formed debris fan as it was still being eroded along its distal margin, stabilizing a few hours later with the river at about half of its former width. The Ledge Hole, which had a new rock lodged on its left side, is a different shape, with a sharper drop and a stronger wave, but also affording passage along the left side. The Big Wave has disappeared because more water is flowing down the right side, while the V-Wave has stronger hydraulics. The vegetation in Prospect Creek was removed by the debris flow.
Dominic Oldershaw
26 March 1996
This image was taken just before the 1996 controlled flood through Grand Canyon at a discharge of 5,000 ft³/s. The debris fan has been partially reworked, widening the rapid, but is still constricts the river more than in 1990. Although the desert vegetation in the foreground appears much the same as it did in 1990, pricklypear cactus and cholla are now just visible, heralding a major change in the view.
Dominic Oldershaw

8 April 1996
This image was taken just after the 1996 controlled flood, which peaked at about 47,500 ft³/s and lasted for 5 days. During the rising limb of the flood, about 5,900 cubic meters of material were removed from the debris fan, increasing the width of the rapid by five meters. Ten boulders with radio tags embedded in their sides moved an average of 750 feet downstream, and one of the smallest reached the top of Lower Lava Rapid. The Big Wave reappeared, and the left run became rocky.
Dominic Oldershaw

29 March 2003
The river channel has not changed since the 1996 flood. A few new barrel cacti have become established in the foreground, and the creosotebush appear to be much larger than they were in 1890. Lack of disturbance on the debris fan has permitted the re-establishment of riparian vegetation, mostly tamarisk and mesquite with desert broom between the larger species.
Thomas O'Dell
11 March 2005
The rapid appears unchanged in the two years between photographs, although subtle changes in the 10 years since the debris flow and 9 years since the reworking flood have altered the left run even more, making it difficult to navigate for most multiperson watercraft at typical water levels. The pricklypear has grown somewhat larger, and a cholla has become established in the left foreground. The riparian vegetation has continued to increase in stature and density.

Bruce Quayle

27 September 2010
The foreground vegetation is similar, although the pricklypear and cholla having grown in stature and are now an obvious element in the view that was not present in 1890. The riparian vegetation, leafed out in the warm season, appears to be denser, reflecting increases in size for all individuals previously established and perhaps new individuals of desert broom. There have been no changes to the rapid.

Bill Lemke
27 February 1890
Turning his camera away from the commanding view of Lava Falls Rapid and the up-canyon view of Prospect Canyon, Stanton took this upstream view, showing desert vegetation in the foreground and the river channel in the midground. Creosotebush and barrel cacti are the dominant plants, and Mormon tea is also present.
Robert B. Stanton, 57-RS-619, courtesy of The National Archives

11 February 1990
Most of the creosotebush persist, as does one Mormon tea. While none of the original barrel cacti have survived, the number of individuals present has more than doubled. Beavertail pricklypear, Engelmann pricklypear and cholla are also present in the view. Tamarisk and mesquite now grow along the river corridor.
Robert H. Webb

10 March 1993
In the three years between photographs, the pricklypear and cholla have increased greatly in size in response to high rainfall at this time. There has been little change to the barrel cacti and creosotebush, although the latter is leafier, obscuring some of the other plants.
Gary B. Bolton
29 March 2003
A decade later, the creosotebush appears to have died back in response to the early 21st century drought conditions. More barrel cacti are now visible, although some were likely present in 1993 and obscured by the creosotebush. Two of the larger individuals visible in the center have died. The pricklypear and cholla have died back considerably but remain in the view.
Thomas O’Dell

27 September 2010
Several more of the barrel cacti have died without replacement, but overall the number of barrel cacti is greater than in 1890. Pricklypear appears to have increased, and the creosotebush, now smaller in stature after years of drought, have mostly persisted since 1890. The riparian vegetation is leafed out and appears to have increased in the last 20 years.
Bill Lemke
27 February 1890
About a mile below Whitmore Rapid, Stanton took this photograph with distinctive desert vegetation in the foreground. A large barrel cactus sits close to the tripod, and ocotillo, creosotebush, and more barrel cacti are all prominent. Stems of desert trumpet can be discerned in the foreground. Several sandbars line the river channel.
Robert B. Stanton, 57-RS-628, courtesy of The National Archives

21 February 1991
The large barrel cactus has died, although the species is still present in the view, and cottontop cactus, which superficially resembles barrel cactus, is also present (left midground). At least two of the ocotillo have persisted the century, while several new ones have become established. Some of the same creosotebush persist, and desert trumpet still grows in the area. Several new cacti are now growing in the foreground, including beavertail pricklypear and Fendler hedgehog. The gravel bar at lower left has increased in size, and the sandbar downstream of it now contains scattered vegetation.
Dave Edwards

28 September 2010
The large barrel cactus has died, although the species is still present in the view, and cottontop cactus, which superficially resembles barrel cactus, is also present (left midground). At least two of the ocotillo have persisted the century, while several new ones have become established. Some of the same creosotebush persist, and desert trumpet still grows in the area. Several new cacti are now growing in the foreground, including beavertail pricklypear and Fendler hedgehog. The gravel bar at lower left has increased in size, and the sandbar downstream of it now contains scattered vegetation.
John Mortimer
Mile 189.0, Below Whitmore Rapid, Upstream View from River Right (Stake 1514b)

27 February 1890
Ocotillos frame this view looking upstream toward Whitmore Wash and its array of sandbars, one of which is visible in the distance below the triangular-shaped butte. Creosotebush, catclaw, and Mormon tea are abundant on the foreground slope, which also supports several barrel cacti. Several sandbars are visible on both sides of the river channel, including a wide, unvegetated one at right center.
Robert B. Stanton, 57-RS-627, courtesy of The National Archives

21 February 1991
The ocotillo on the left side of the image has died, but the one on the right now largely obscures the image. Creosotebush, catclaw, barrel cacti, and Mormon tea are still common, with some of the individuals persisting, particularly the two individuals in the foreground that are subtly visible in the 1890 view. Brittlebush, beavertail pricklypear, and cottontop cactus are now present. Some vegetation, likely tamarisk, now grows upon the sandbars.
Dave Edwards

28 September 2010
The ocotillo is leafed out, indicating recent rains. Many of the plants that had survived the century continue to persist, including the ocotillo, creosotebush, catclaw, and Mormon tea. Barrel cactus is now more abundant than it was two decades earlier, and riparian vegetation has increased in both stature and density.
John Mortimer
**Mile 193.0, 193-Mile Canyon, Downstream View from River Left (Stake 1515)**

**28 February 1890**

When Stanton made this image on the last day of February 1890, creosotebush, desert broom, mesquite, Anderson thornbush, perennial grasses, and pricklypear grew in the foreground. The beach at midground is partially covered with boulders and has large amounts of driftwood on its surface. A small sandy island is in the middle of the river channel, while there is a large sand beach, with catclaw growing along the high-water line, on the opposite shore.

Robert B. Stanton, 57-RS-632, courtesy of The National Archives

**21 February 1991**

A century later, the prominent creosotebush and Anderson thornbush at center are still alive, as is the mesquite, although it has died back somewhat. The desert broom that was alive in 1890 has died, although other individuals of this species are now present. The perennial grasses are gone from the foreground, and biological soil crust—with some trampling through it—is visible in the left foreground. The beach is mantled with desert broom, arrowweed, and non-native tamarisk.

Raymond M. Turner

**28 September 2010**

The desert vegetation in the foreground—creosotebush, Anderson thornbush, and mesquite—have changed little in the ensuing two decades. The path through the biological soil crust is more distinct, although non-native red brome, a winter annual, obscures much of the sand dune with its dead stalks. The sandbar is now more heavily vegetated with desert broom and common reed dominating. Tamarisk occurs on both shorelines throughout the view.

Bill Lemke
28 February 1890
Stanton hiked to the top of a stabilized sand dune to take this view, which looks upstream at a gravel bar in the foreground, columnar basalt at left, and sandbars lining the river corridor. In the foreground, creosotebush, mesquite, perennial grasses, and pricklypear are the dominant plants. The vegetation growing along the high-water line at the center of the image is probably a combination of mesquite and catclaw.
Robert B. Stanton, 57-RS-636, courtesy of The National Archives

22 February 1991
Around the time of Stanton’s visit, populations of feral burros, which had either escaped from or were released by miners, became established in Grand Canyon, including one group in the lower canyon. They were not eradicated until the 1980s. The foreground vegetation shows signs of having been both trampled and grazed, and desiccated burro dung was found near the camera station. The foreground vegetation has undergone considerable turnover, although the species composition is similar, with the exception of the perennial grasses which are no longer present. The old high-water line across the river in the midground and background remains prominent.
Dave Edwards

29 September 2010
A number of the same foreground plants present two decades before persist, although the Engelmann pricklypear has died back considerably. Perennial grasses have increased on the foreground slope, and those with a general straw-yellow cast are dead red brome, a non-native winter annual. The gravel bar at right midground is now partially vegetated with brickellbush and seepwillow. Riparian vegetation has also increased on the beaches lining the river corridor in a combination of native species with non-native tamarisk. The old high-water line appears to be locally disintegrating, although some segments remain dense with native mesquite and catclaw.
John Mortimer
1 March 1890
The first of March was a busy day for the Stanton expedition. After running 205 Mile Rapid, the crew made twenty miles and Stanton photographed twenty-three views. This downstream view, made at 8:00 AM, was one of his first that day. His railroad likely would have passed through the foreground, a bench on top of the Tapeats Sandstone. The view shows desert vegetation with a diversity of species present, including ocotillo, creosotebush, barrel cactus, and a small hemispheric shrub that likely is white bursage.

Robert B. Stanton, 57-RS-643, courtesy of The National Archives

23 February 1991
The downstream view from the mouth of Indian Canyon is one of twenty that show the effect of burro grazing on desert vegetation in Grand Canyon. This site had heavy burro use that ended ten years before this view was made; numerous animal trails cross through the foreground of this view. Most of the perennial plants present in 1890 are gone; only three ocotillos, a creosotebush, and five individuals of Mormon tea persist. The ocotillos in the view have scars at their base caused by burro grazing and subsequent healing. The most abundant plant in the foreground of the 1890 view, interpreted to be white bursage, had twenty-nine individuals, all of which are now dead. Only one seedling of white bursage, which is not visible in the view, was found at the site. Four individuals of barrel cactus are visible in the 1890 view; thirty are visible in the 1991 view. The change likely resulted from a decrease in the frequency of severe frosts in Grand Canyon.

Raymond M. Turner

30 March 2003
One of the prominent ocotillo at left center has died, possibly in response to the early 21st century drought, and its carcass is visible on the rocks below. Some of the barrel cacti have died, and some of the smaller shrubs have died or died back.

Thomas O’Dell
13 March 2005
The desert vegetation in the foreground is similar although some shrubs are larger, probably growing in response to high precipitation in the winter of 2004-2005. The ocotillo carcass is decreasing in volume as the dead plant material decomposes.
Bruce Quayle

29 September 2010
Several more of the barrel cacti have died, and only one new one is apparent. Some of the other shrubs appear to have died or died back, again in response to overall drought conditions that have persisted much of the 20 years following the first match of this view in 1990. The ocotillo carcass is mostly gone, the result of decomposition. The river is red and laden with sediment injected in runoff in the Little Colorado River basin.
Steve Tharnstrom
1 March 1890
Not far upstream from Three Springs Rapid in western Grand Canyon, Stanton took this view in a river bend to gain the greatest amount of coverage of the river corridor where his railroad would one day, in his planning, pass through Grand Canyon. This view shows mesquite and creosotebush in the foreground and a slope with ocotillo in the right midground. Three sandbars, barren of vegetation, appear in the view.

Robert B. Stanton, 57-RS-650, courtesy of The National Archives

24 February 1991
A century later, the mesquite and creosotebush have persisted, and brittlebush is also visible in the foreground. Ocotillo continue to mantle the slopes in the right midground. The sandbars are now densely covered by grasses, mostly non-native Bermuda grass.

Dave Edwards
Mile 215.2, Upstream from Three Springs Canyon, Downstream View from River Left (Stake 2009b)

1 March 1890
Stanton and his crew were in a hurry to find Diamond Creek, but he also was disciplined enough to continue his systematic documentation of his railroad route. He stopped above Three Springs Canyon on the left to photograph his proposed route, which would have traversed the right bank, through a right-hand bend. Only by accident did Stanton include desert vegetation in his view. Only two barrel cacti appear in this view, the most obvious on the far left side. Several inconspicuous brittlebush appear in the midground at left and center of the view.

Robert B. Stanton, 57-RS-651, courtesy of The National Archives

24 February 1991
This view has the most persistent species of any Stanton view: eight. Although turnover is readily apparent, particularly in pricklypear and cholla, most of the shrubs are still alive after a century. These species are creosote bush (lower left), range ratany (midground center), Mormon tea (several individuals throughout the view), Fremont thornbush (midground at center), Anderson thornbush (left foreground), beavertail (lower center), buckhorn cholla (lower right), and mesquite (midground at center). The density of plants is much higher in 1991, but the increase is mostly in formerly frost-limited barrel cactus and brittlebush. Twenty-two barrel cacti are visible in the 1990s view; similarly, brittlebush has increased dramatically. This view, more than most, illustrates the framework of climatically insensitive species around the suite of frost-sensitive species. At this site, ungrazed by burros, long-lived species persist with little turnover compared with the relatively large turnover in grazed vegetation on river right.

Dave Edwards

29 September 2010
Again, turnover has occurred in this view, but the increase in barrel cacti and brittlebush continues while most of the other individual desert plants have persisted. Riparian vegetation, mostly tamarisk, has increased along both banks. Despite prolonged drought in the intervening 19 years, plant biomass in both the desert and riparian vegetation has increased, reducing the amount of open space visible from this camera station.

Bill Lemke
01 March 1890
From a granitic hillslope above the Colorado River at Trail Canyon Rapid, Stanton took this image looking back up the canyon. A small beach is visible in the center foreground, and Mormon tea, creosotebush, and barrel cacti, catclaw, and mesquite grow on the bedrock slope in front of the camera station.
Robert B. Stanton, 57-RS-656, courtesy of The National Archives

26 February 1991
Some of the Mormon tea and creosotebush have died, while others persist, as do mesquite and catclaw. None of the same barrel cacti are present, although new ones have become established. Brittlebush is common here, and some sweetbush is present. The water level is lower than it was in 1890, so the sandbar on river left appears to be larger but is probably similar in size. The sandbar in the foreground center is now vegetated, mostly with non-native tamarisk.
Liz Hymans

29 September 2010
Nineteen years later, some of the original catclaw, Mormon tea, mesquite, and creosotebush are still alive. Some of the barrel cacti have died, while several have increased in size, and many of the brittlebush and the sweetbush have persisted. Vegetation in the riparian zone, including tamarisk, brickellbush, arrowweed, and common reed, has increased greatly, obscuring the view of the sandbar in the foreground.
John Mortimer
01 March 1890
The rocky debris fan from Trail Canyon dominates this view, which extends downstream to the now heavily used camp at 220 Mile Canyon. While it is largely unvegetated, a few coyote willows grow along the margins of the debris fan. On the granitic slope in the right foreground, a variety of desert plants, including catclaw, creosotebush, beavertail pricklypear, Mormon tea, barrel cacti, mesquite, and Anderson thornbush, are present.

Robert B. Stanton, 57-RS-657, courtesy of The National Archives

26 February 1991
The debris fan has aggraded a foot or two from a debris flow that occurred sometime in the preceding century, but its size is largely unchanged in the past century. The coyote willow are gone, but the sandbar in the near foreground has a cover of tamarisk, arrowweed, and baccharis. Some of the Mormon tea, catclaw, creosotebush, and mesquite persist, and Anderson thornbush likely does as well. Brittlebush is common here now.

Liz Hymans

29 September 2010
What appear to be streamflow deposits continue the aggradation of the debris fan that forms Trail Canyon Rapid, a small riffle in western Grand Canyon. Riparian vegetation, mostly tamarisk, mostly obscures the surface of the debris fan and sandbar. Many of the same barrel cacti, beavertail pricklypear, catclaw, and mesquite are still present, but some of the brittlebush have died.

John Mortimer
1 March 1890
In the warmer, more open Western Grand Canyon, this upstream view shows an island and backwaters in a river with little riparian vegetation along its banks. The old high-water line, which is discontinuous in this reach, consists of mesquite and catclaw. The foreground slopes support an assemblage of creosotebush, brittlebush, white bursage, and ocotillo.

Robert B. Stanton, 57-RS-659, courtesy of The National Archives

26 February 1991
When botanist Ray Turner visited the site 101 years later, he found many of the same creosotebush, a few persistent white bursage, and one new barrel cactus (right center). The ocotillo has died, but two new ones are present. The sandbar behind the island is somewhat smaller, but it is stabilized by arrowweed with some tamarisk nearby. The small island is now vegetated, likely with arrowweed, tamarisk, and seepwillow.

Raymond M. Turner

30 September 2010
Riparian vegetation growing on the island and the sandbars is now much denser, and the former backwater area is mostly gone. The desert vegetation has likewise increased in biomass, although the creosotebush all persist. Three barrel cacti are now visible, including the one present in 1991.

Robert H. Webb
01 March 1890
When the Stanton expedition saw Diamond Peak, which dominates this downstream view at mile 222.6, they knew their goal of Diamond Creek and access to the outside world was within reach. Stanton eagerly wanted to hike out to the railroad and telegraph at Peach Springs, 26 miles up Diamond Creek. Despite their eagerness, documentation of the railroad route came first, hence this photograph. In the foreground, creosotebush and buckhorn cholla are visible on an eolian sand dune, and the branches of an ocotillo extend into the view at lower left.
Robert B. Stanton, 57-RS-660, courtesy of The National Archives

26 February 1991
A debris flow that occurred sometime before 1965 has deposited numerous boulders and cobbles on the dune, altering the previous foreground. The tributary that produced the debris flow, out of the view to the left, is unnamed but typical of small canyons that are common in western Grand Canyon. Despite the deposition, most of the creosotebush have persisted the last century. Just over the foreground plants, a new sandbar is visible on the left side of the Colorado River, possibly the result of an increased constriction out of the view to the right caused by the debris flow. This sandbar is mostly obscured with a cover of tamarisk, seepwillow, and coyote willows.
Raymond M. Turner

30 September 2010
The debris flow levee that dominates the foreground appears to have changed little in the past two decades. Creosotebush continues to persist, although the individual plants are much larger. At least one ocotillo persists from 1991, but none of the ocotillo present in 1890 persists. The riparian vegetation, leafed out in the warm season, has greatly increased, and individual tamarisk trees tower above the surrounding native species.
Robert H. Webb
Mile 229.0, Travertine Canyon, Upstream View from River Left (Stake 2553a)

12 March 1890
Stanton’s diary assumes a decidedly engineering tone in the first few days after he resumed his trip downstream of Diamond Creek. For example, in describing this upstream view Stanton states: “Broken up into a general slope, though the slope is not so flat as above, with points of harder rock standing up over the general slope. These must be cut very heavy in order to give a good line. But it will make a magnificent roadway.”
Robert B. Stanton, 57-RS-673, courtesy of The National Archives

29 February 1992
Travertine Canyon (mile 229.0) has perennial flow and is a popular stop for river trips that extend below Diamond Creek. The view upstream from its mouth mostly shows Vishnu Schist and granite in walls that appear unchanged over the last century. River level is quite similar to Stanton’s view. A catclaw persists from 1890 in the right midground, with California buckwheat and toothleaf goldeneye on the slope below possibly representing unidentifiable shrubs from Stanton’s view. The Tapeats Sandstone in the foreground is evidence of a debris flow.
Tom Wise

23 April 2011
River level is similar to that in 1992 and at the time of Stanton’s original photograph. The catclaw persists on the right upper slope, while tamarisk now is common along the water’s edge on both sides of the river.
Robert H. Webb
12 March 1890
This downstream view shows the debris fan at the mouth of Travertine Canyon from upstream. There is no vegetation apparent in the foreground, although beyond the boatman sitting on a prominent rock in the left foreground, a few shrubs appear on the left slope.
Robert B. Stanton, 57-RS-674, courtesy of The National Archives

29 February 1992
Bob Webb poses in the same position as the Stanton boatman. A debris flow in the past century has deposited more material in the foreground of this view, but some large boulders are still recognizable in the lower right corner, and the center foreground. Bastardsage has appeared in the rocks behind the model, a small catclaw is in the center of the view behind a small sweetbush.
Tom Wise

23 April 2011
Even with moderate foot traffic in this popular spot, most of the smaller rocks remain in place, and the catclaw persists in the center. The lower right corner of this view is dominated by sweetbush, which has persisted under the center catclaw and become established on the left slope. Beyond the large sweetbush at lower right, slender poreleaf and buckwheat persist from 1992. Dead catclaw wood remains behind where Webb and the boatman posed in previous photographs.
Robert H. Webb
12 March 1890
In Travertine Canyon, a short distance from the Colorado River in western Grand Canyon, the walls narrow and the creek cascades down the slick face in a refreshing waterfall. Travertine Creek has downcut through a massive travertine deposit, and this view shows part of the short narrow slot canyon. There is not much flow over the gravelly canyon floor in Stanton’s view, but water cascades down the left side of the back wall. No vegetation appears in this section of the canyon.
Robert B. Stanton, 57-RS-676, courtesy of The National Archives

29 February 1992
Travertine Canyon’s walls are unchanged in the 102 years since Stanton’s visit, and the flow in 1992 was very similar to that of the original. High-flow events and flash floods continue to make this section inhospitable to vegetation, but sediment deposited during episodic flash floods is apparent along the base of the right canyon wall.
Ted Melis

23 April 2011
Flow from the waterfall has moved to the right side of the rock face and pooling has occurred along the wall at right center. Flow is more substantial than in 1992 and 1890, and the base of the left wall has been scoured. In the center of the view a small ledge has been exposed by erosion, creating another very small waterfall in this canyon.
Robert H. Webb
12 March 1890
The expedition pulled into a debris bar downstream from Travertine Canyon to take upstream and downstream photographs of this section of Grand Canyon. Stanton’s camera station is close to the center of the river in this view; the debris bar extends out from the bank on river right and is emergent at this water level, which is around 10,000 cfs.
Robert B. Stanton, 57-RS-677, courtesy of The National Archives

1 March 1992
The debris bar that the camera station is on is devoid of vegetation in 1992 and has been reworked by the river, but the debris fan upstream in the center of the view on the right bank appears unchanged. After the high dam releases of the mid-1980s, riparian vegetation, including non-native tamarisk, has not reestablished along the river corridor in significant quantity in this reach.
Ted Melis

24 April 2011
The water level is higher than in 1992, making it extremely difficult to occupy the same camera station, and the match is slightly too far to the left and too far back. Tamarisk is scattered throughout the foreground, emerging from the rising river. On the cliff face to the left, barrel cactus and brittlebush appear, and seepwillow and phragmites are growing at the water’s edge.
Bill Lemke
12 March 1890
The most striking detail of this view is the sand deposits on the upper banks on both sides of the river, deposited during the annual floods of the pre-dam era. Above the sand deposits are shrubs on the slopes, which are unidentifiable and the only vegetation in the view. The cobbles that the camera is stationed on appear high and dry and devoid of vegetation.
Robert B. Stanton, 57-RS-678, courtesy of The National Archives

1 March 1992
The river is approximately 2 feet lower than in Stanton’s view, though the cobble bar has been reworked by the river and no rocks from 1890 are recognizable. The cobble bar is still not a host to riparian plants, owing at least in part to the high dam releases of the preceding decade. The high sand deposits on the banks are still present, though they are deflated and colonized by vegetation. The slopes above the sand deposits are dominated by brittlebush.
Ted Melis

24 April 2011
Owing to the difficulties of matching on a cobble bar, the camera station is slightly off and is too far into the view. The river is higher, and the 1890 and 1992 camera stations are in the river. Many of the rocks present in 1992 are readily identifiable, despite 19 years of river reworking and the slight difference in the match. The sand deposits have been obscured by vegetation that has grown up since 1992, and the cobble bar has been colonized by riparian plants, mostly non-native tamarisk and native desert broom. Tamarisk dominates the river’s edge on both banks, and arrowweed has established on the upper slopes among the brittlebush, some of which appears to persist the intervening 19 years.
Bill Lemke
13 March 1890
By the time Stanton and crew reached western Grand Canyon, they had developed sufficient boating skills to run what are now considered large rapids. These included 231-Mile and 232-Mile Rapids, which they ran on 13 March 1890 with little note or trouble. Below 232-Mile Rapid, Stanton stopped at 9:15 AM to capture this upstream view. He placed his camera only a short distance from his boat, which is uncharacteristic of his other views.
Robert B. Stanton, 57-RS-684, courtesy of The National Archives

15 March 1993
232-Mile Rapid is the last whitewater of significance in Grand Canyon, primarily because of some rocks in the tailwaters that become emergent and dangerous at low dam releases. The river flows freely for another four miles or so, depending on the level of Lake Mead. The gorges through schist and granite are well-known for their boils and whirlpools, informally referred to as "swirlies." Both the original and replicate views artistically show this turbulence well. Steve Tharnstrom matched Stanton’s view on March 15, 1993, at 12:07 PM.
Steve Tharnstrom

24 April 2011
In the 18 year interim, there has been little change in this view. At the water’s edge pockets of tamarisk appear along river right. Vegetation on banks appears new, but may be present on previous leafless winter match. As in 1993, this view was matched using a neutral density filter to replicate the water surface in Stanton’s. This resulted in a long exposure, which was difficult in gusty winds.
Steve Tharnstrom
13 March 1890
Stanton continued to document his proposed railroad route by taking upstream and downstream photographs in every river bend. His camera station sits on a sandy terrace strewn with driftwood in this downstream view. Anchored in the rocks to the left of center, catclaw, toothleaf goldeneye, and bastardsage can be readily identified.

Robert B. Stanton, 57-RS-686, courtesy of The National Archives

15 March 1993
During the intervening 103 years, most of the sand has been eroded from this terrace, exposing the rocks beneath. The driftwood has been swept from the view, possibly as recently as the large dam release of 1983. Vegetation has become established, with sweetbush and more bastardsage in the foreground. The catclaw, toothleaf goldeneye, and bastardsage persist on the left wall.

Liz Hymans

24 April 2011
Little erosion has taken place in the intervening 18 years, as evident by the development of biological soil crusts in the foreground. The catclaw and bastardsage still persist from 1890 on the left wall, and the foreground is dominated by sweetbush. The bastardsage at the left edge of the foreground persists from 1992 as does the adjacent slender poreleaf.

Steve Tharnstrom
13 March 1890
Stanton secured this long upstream view in Lower Granite Gorge from a right-hand bend. Bare sand and rock extends upslope beyond Stanton’s camera station in this view. Bastardsage and catclaw appear in the right midground, but otherwise the foreground is devoid of vegetation. Beyond the sandy foreground, bastardsage appears in the rocks at the center of Stanton’s view.

Robert B. Stanton, 57-RS-685, courtesy of The National Archives

15 March 1993
More sand has been deposited at this camera station, but the foreground rocks appear to mostly be unchanged. Big galleta grass has colonized the sandy patch with catclaw in the rocks beyond the open sand. The river level is considerably lower than in 1890, exposing more of the small beach on river right that sustains non-native tamarisk. Catclaw and bastardsage persist on the right slope, although at least one individual of bastardsage has died. Mormon tea has appeared lower on the same slope.

Liz Hymans

24 April 2011
Big galleta grass has increased in the sandy foreground, as well as the catclaw beyond. The tamarisk on the opposite beach has increased considerably in size. Most impressively, the catclaw in the right midground persists and is well over 121 years old.

Steve Tharnstrom
Mile 242.5, Below 241-Mile Rapid, Upstream View from River Right (Stake 1926)

11 March 1890
Because Stanton had little control of his camera’s exposures, and light meters had not even been invented yet, some of his views are overexposed. Stanton’s upstream view shows a bare scree slope to the left leading directly into the river. A large shrub, possibly a creosote bush, is cut off on the right side.
Robert B. Stanton, 57-RS-689, courtesy of The National Archives

11 March 1998
The most striking aspect of this match is the rise in water level, the result of Lake Mead water level that was high at this time. The original camera station is well under water, as is evidence from changes in the skyline details and the view angle on the midground cliffs. This image, taken from a boat using a hand-held 35 mm camera, encompasses a smaller field of view than Stanton’s photograph.
Dominic Oldershaw

25 April 2011
Years of drought across the Southwestern United States resulted in a lowering of the reservoir level between the first and second matches. Stanton’s camera station is now just above the level of the lake, enabling us to accurately replicate his photograph with a 4 x 5 view camera. The large flat rock visible along the water line at right center, clearly visible in the 1890 image, has not moved. Above this rock, a dead stump, possibly from a catclaw, may persist from a tree alive in 1890. In the lower right corner, some dead plant material may also remain from Stanton’s time. Seepwillow and tamarisk dominate the banks of the reservoir.
Steve Tharnstrom
11 March 1890
Stanton typically set up his camera in river bends to get long views of the canyon and show the proposed railroad route. In this reach, his railroad would have traversed the right side of the view, which is barely visible in this downstream view. Stanton’s photograph shows a rocky Lower Granite Gorge with little vegetation on the banks or bedrock.
Robert B. Stanton, 57-RS-699, courtesy of The National Archives

11 March 1998
Stanton’s original camera station is inundated by Lake Mead, which rose into this reach in the late 1930s. This match was taken from a boat using a 35 mm film camera. There isn’t much to interpret in this match.
Dominic Oldershaw

25 April 2011
A digital single-lens reflex camera was used to match this view, again from a boat. The lake level drop, which resulted from reduced inflows into Lake Mead during the early 21st century drought, shows as a white bathtub ring on the left side. Some riparian vegetation – mostly non-native tamarisk – appears in little coves in the lake.
Steve Tharnstrom
11 March 1890
Downstream from Separation Rapid, a difficult reach of whitewater whose difficulty was exaggerated by Powell, Stanton personally needed to dry off following a swim in its tailwaters. 241-Mile Rapid was still a significant rapid but nothing compared to either Separation or Lava Cliff Rapids. Stanton’s camera station is on a rock shelf above the river. The right bank shows signs of rockslides and falls from the cliffs above, as evident from the large, rectangular boulders near the water’s edge.

Robert B. Stanton, 57-RS-700, courtesy of The National Archives

11 March 1998
The original camera station is inundated by Lake Mead, and this match was taken from the boat using a 35 mm camera. Vegetation has colonized the water’s edge at the right foreground. The background limestone cliffs and slopes remain unchanged.

Dominic Oldershaw

25 April 2011
A digital single-lens reflex camera was used to match this view from a boat. Lake level is lower than in 1998, exposing more deltaic deposits in the foreground and allowing more vegetation to become established.

Steve Tharnstrom
Mile 246.0, Spencer Canyon, Upstream View from River Left (Stake 1934)

11 March 1890
Spencer Canyon once formed the fearsome Lava Cliff Rapid, which was both difficult to run and dangerous to portage. While pulled in on the left bank upstream from this canyon mouth, Stanton took this photograph showing largely barren channel banks and walls. Two of his boats are parked in the center foreground, giving a scale as to the size of the rocks making up the left bank of the river.

Robert B. Stanton, 57-RS-705, courtesy of The National Archives

11 March 1998
Lake Mead, impounded by Hoover Dam, finally reached this part of western Grand Canyon in the late 1930s, eliminating the rapid and creating a new riparian zone at the lake level. This match was taken with a hand-held 35mm camera from a boat.

Dominic Oldershaw

25 April 2011
This view was taken from the boat by hand-held digital single-lens reflex camera. The level of Lake Mead had dropped from 1998, responding to reduced inflow during the early 21st century drought, then stabilized, and non-native tamarisk and native seepwillow flourished along the newly exposed banks.

Bill Lemke
**Mile 3.0, Water Canyon, Upstream View from River Right (Stake 3913)**

**30 May 1889**

This view shows a relatively high level of flow in the Green River upstream from the Confluence. Short riparian species line the river banks. We cannot know what these plants are, but compared with other areas, the most likely species is desert olive with perhaps some coyote willow intermixed.

Franklin A. Nims, 57-RS-19, courtesy of The National Archives

**14 October 1999**

Tamarisk became very common along the Green and Colorado Rivers in the early 20th century, and in 1999, it dominated the woody riparian ecosystems along the Green River. This reach is no exception. Although the riparian zone was nearly impenetrable at this time, some native species could remain under the shade of the non-native trees.

Sam Walton

**28 July 2010**

The tamarisk, once thick and continuously lining the river corridor, is dead or dying from the tamarisk leaf beetle infestation, intentionally released to control this non-native species.

Robert H. Webb
30 May 1889
At this point, just upstream from the Confluence, the Brown-Stanton expedition paused while Nims captured this upstream view of the Green River. The water level is high, and little riparian vegetation is present, affording an unobstructed view of the channel banks and canyon walls. One tree, a Goodding willow, is present in the little bend on the left side of the view.
Franklin A. Nims, 57-RS-20, courtesy of The National Archives

14 October 1999
Tamarisk lines the banks of the Green River, occupying all available unconsolidated sand and growing in cracks in the bedrock, which is Honaker Formation at river level. The Goodding willow persists within the sea of tamarisk, but other native species are present as well.
Steve Young

28 July 2010
The tamarisk leaf beetle has killed or set back the tamarisk in this reach, except some trees that are overhanging the river, which for unexplained reasons are resistant to the beetles. The light green coyote willow, closer to river level than the browning tamarisk, is highlighted in this view.
Robert H. Webb
30 May 1889
This view from the left bank shows the Confluence in the distance. This view, Nims’ first that shows the proposed railroad route, shows a place where the boulder-strewn slope meets the fine-grained bottomland, and the desert vegetation here reflects those edaphic conditions. Mormon tea is scattered through the rocks, while various species of saltbushes grow in the fine-grained soil and behind a line of riparian species, which are a combination of netleaf hackberry and desert olive. One peachleaf willow tree is just visible in the center. Across the river, boxelders grow behind the native species that line the banks well above water level, which is high in this view.

Franklin A. Nims, 57-RS-24, courtesy of The National Archives

24 March 1997
A small debris flow from the Honaker Trail Formation cliffs to the left has crossed the foreground, adding to and changing the configuration of rocks in the foreground. Despite the substrate changes, several Mormon tea and numerous four-wing saltbush plants persist in the view, and perennial grasses, including needle-and-thread and Indian ricegrass, are present but probably not persistent from 1889. The riparian zone is dominated by non-native tamarisk, although netleaf hackberry, desert olive, and coyote willow are also present; boxelders are scattered along the banks, and the peachleaf willow persists.

Robert H. Webb

28 July 2010
The tamarisk are dead or dying from the infestation of tamarisk leaf beetles, which were deliberately released as a control measure for this non-native species more than 50 miles upstream. Shrubs and some perennial grasses persist despite the regional drought, and no new debris flows have occurred, lending stability to the desert ecosystem here in contrast to the riparian zone. A few grizzlybear pricklypear cacti are now apparent in the view.

Helen A. Raichle